INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Vol. 24
No. 2

PUBLISHED MONTHLY BY THE BRUCE PUBLISHING COMPANY, 524-544 NORTH MILWAUKEE STREET, MILWAUKEE, WISCONSIN.
Eastern Office: 40 E. 34th St., New York, N. Y.—Western Office: 66 E. South Water St., Chicago, Ill.

CONTENTS

The School Shop

Vocational Education's New Deal, *by Charles W. Sylvester*..... 33
Industrial-Arts Research, *by William E. Warner*..... 38
High-School Mechanical Drawing, *by R. P. Hoelscher*..... 46

The General Shop

General Shop for Rural Schools, *by Ray L. Hamon and H. E. Standish* 49
A Practical General-Shop Plan, *by Earl S. Miller*..... 54

Shop Management

Tool Records Determine Needs, *by Noel B. Grinstead*..... 59
Evaluating Pupils' Work in Shop, *by Gerald Baysinger, G. Harold Silvius, and Earl L. Bedell*..... 61
Rating Industrial-Arts Teachers, *by August Flam*..... 62

What Others Are Doing

Hadley Auto Department, *by A. B. Jordan*..... 64

The School Shop and Leisure

The Home Workshop, *by Ross C. Cramlet*..... 14A

Shop Courses

Course in Electrical Work, *by H. R. Goppert*..... 17A

Our Supplement

Nautical Weather Vanes, *by C. E. Bradley* (Supplement No. 305)..... 38A

Equipment and Supply Lists

Woodworking 8A
Printshop 22A
Metal-Working 27A
Automotive 33A
Drafting 37A
Electrical 44A
School Shop Equipment News..... 38A

BRUCE'S SCHOOL SHOP ANNUAL

This issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION again brings the BRUCE'S SCHOOL SHOP ANNUAL to its readers. The content has been chosen especially because of its fitness for an issue which is to render the double service expected from the SCHOOL SHOP ANNUAL as set up by its seven predecessors, and at the same time serve the thousands of shop teachers who look upon INDUSTRIAL ARTS AND VOCATIONAL EDUCATION as *the* professional Magazine in their field.

Because of lack of space, the Problems and Projects have been omitted from this issue, but this deficiency will be amply taken care of in succeeding issues of the Magazine.

The attention of all readers interested in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is called especially to the articles contributed by Sylvester, Warner and Hoelscher. Those interested in the general shop, may find listed under that heading two very helpful articles. Grinstead's study on determining tool needs is very enlightening, and the other articles chosen for this issue it is hoped will be equally well fitted to make the work of school-shop planning, equipping, teaching, and managing more far-reaching and efficient. The equipment, material and supply lists, and the manufacturer's products lists found helpful in previous editions, have been again included.

Articles Indexed—The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."

Entered Jan. 2, 1914, as second-class mail matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright, 1935, by Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, Nov. 25, 1930.

Subscription Information—Subscription price, $2.50 per year, payable in advance. Canadian postage and tariff, $1.00, foreign countries, 50 cents. Copies not over three months old, 25 cents; more than three months, 50 cents. Notice for discontinuance of subscription must reach Publication Office in Milwaukee, at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions—The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

The Magazine is on sale at Brentano's, New York; Wanamaker's, Philadelphia; Brentano's, Chicago; Philippine Education Co., Manila, P. I.

Stanley Tools

Educational Department New Britain, Conn.

Manufacturers of

Hand Tools for

Woodworking and Farm Shops — The most complete line offered by one manufacturer. Ask for Catalogue No. 34A.

Electrical Shops—Hammers, Bit Braces, Bit Extensions, Screw Divers, etc., Ask for Catalogue No. 34A.

Sheet Metal Shops—Hammers, Chisels, Punches, etc. Ask for Catalogue No. 34A.

Automobile Shops—Body and Fender Tools, Hammers, Chisels, Punches, Pliers, Files, Screw Drivers, etc. Ask for Catalogue No. 26A.

Machine Shops— Hammers, Rules, Chisels, Punches, Levels, etc. Ask for Catalogue No. 34A.

Forge Shops — Anvil Tools, Tongs, Hammers, etc. Ask for Catalogue No. 34A.

Instructors of the shop subjects listed above should have our catalogue when specifying equipment. The catalogues are illustrated below—send for them.

The hard and accelerated usage that tools are subject to in the school shop demands quality tools. For more than three-quarters of a century Stanley Tools have been made to the sound policy of Quality First. Specify Stanley Tools for the utmost in economy and service and avoid substitutions.

Send for these Special School Catalogues

Catalogue No. 26A - Automotive Tools

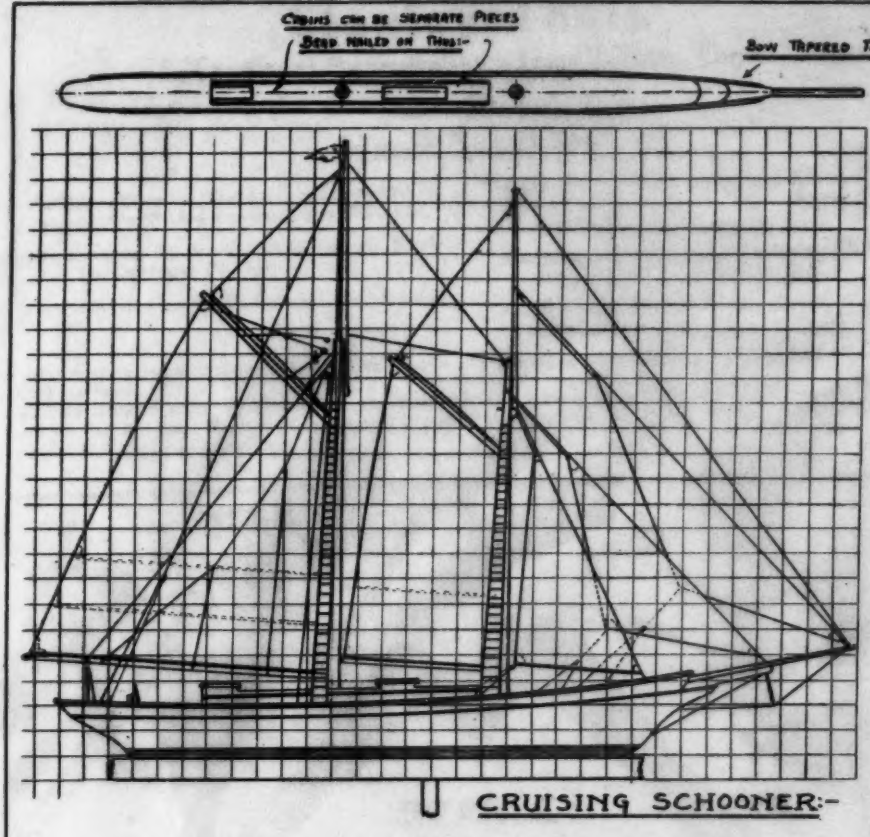
Shows a complete line of hand tools, with the exception of wrenches, and a complete line of Body and Fender Repair Tools. It describes chrome vanadium alloy steel Chisels and Punches, molybdenum alloy steel Pliers, new Screw Drivers with Stanloid handles—the toughest non-metallic substance known — and many other tools of particular value to the school shop.

Catalogue No. 34A with School Index

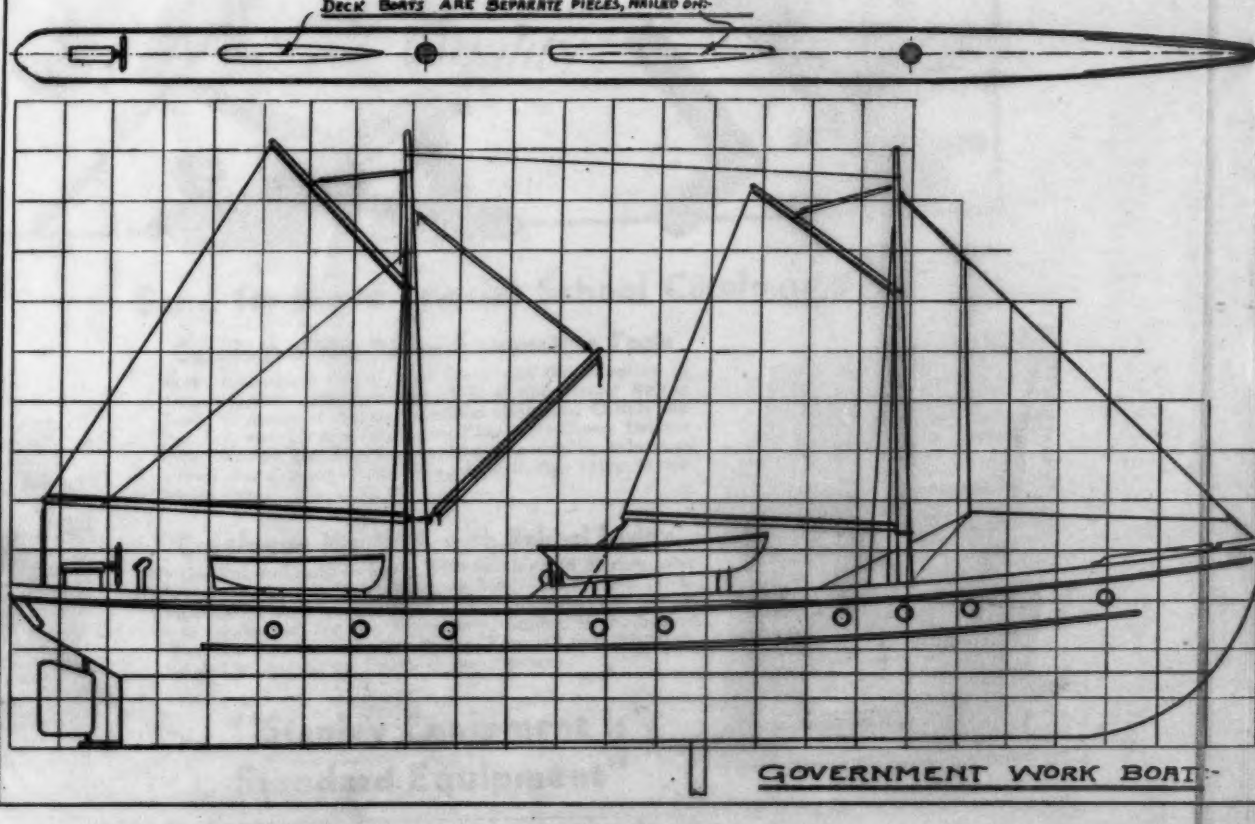
Illustrates and describes over 1500 Stanley and Stanley-Atha Woodworking and Metal Working Tools — 215 pages. It is furnished with a special school index which lists the proper tool equipment for the Elementary, Junior High, Senior High and Vocational School Shops. You will find this book helpful in making up your tool specifications.

"Stanley Equipment is Standard Equipment"

Stanley Tools, Educational Dept. 106 Elm Street, New Britain, Conn.



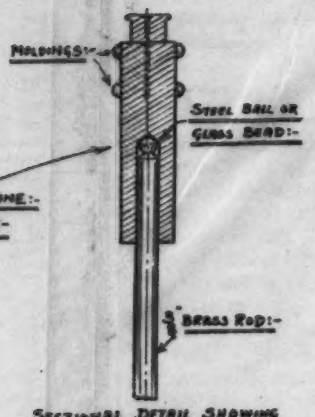
CRUISING SCHOONER:-



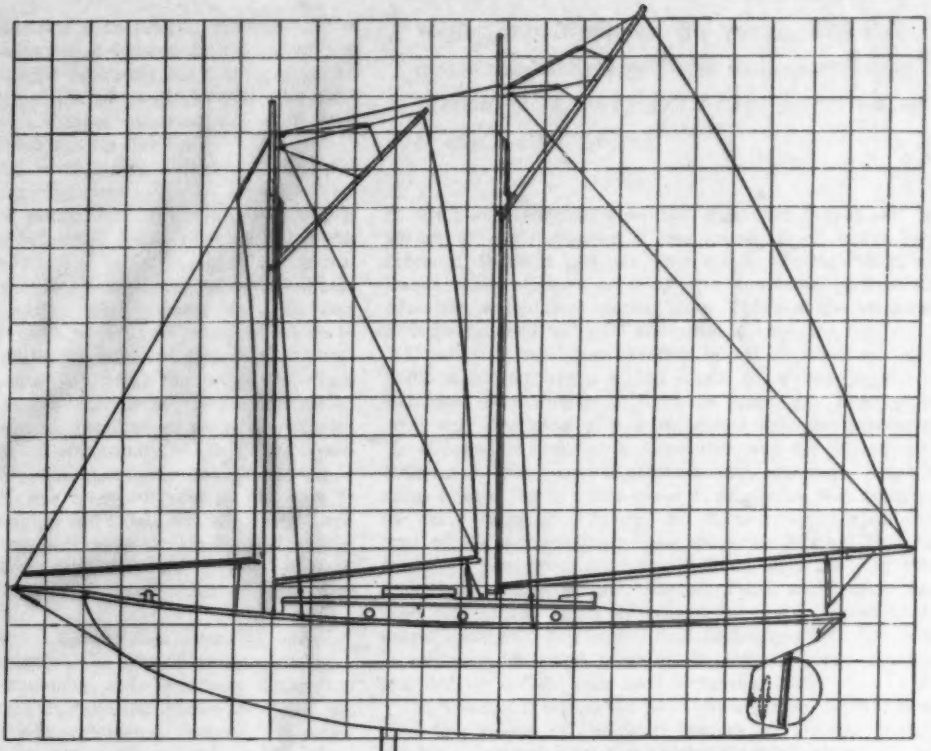
GOVERNMENT WORK BOAT:-

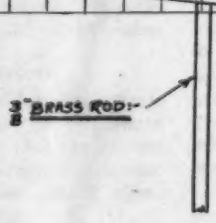
Designed by C. E. Bradley.

To be Reproduced for School-Shop Use Only
Copyright, 1935, The Bruce Publishing Company



SECTIONAL DETAIL SHOWING MOUNTING ARRANGEMENT:-





SCHOONER YACHT:-

HULLS FROM 1¼" WHITE PINE:-

SAILS FROM SHEET BRASS 29 GAUGE, PAINTED WHITE:-

RIGGING FROM FINE, SOFT COPPER WIRE AND 15-THREAD CUTTYHUNK FISH LINE:-

NAUTICAL WEATHER VANES:-

BY

C. E. BRADLEY:-

EACH SQUARE REPRESENTS ONE INCH:-

by C. E. Bradley, Fall River, Massachusetts

Vocational Education's New Deal

Charles W. Sylvester

Director of Vocational Education, Baltimore, Maryland

This article is based on an address given before the Public School Association, November 13, 1934. While it specifically describes conditions in Baltimore, nevertheless it is equally applicable to the conditions prevailing in every one of the larger cities of the United States.

VOCATIONAL Education is an integral and vital part of every modern progressive and successful system of public-school education. General education has a tremendous responsibility in the preparation of youth for life, but one's education is not complete without vocational education. It is this type of education that fits for livelihood.

Specifically, vocational education is that part of the training and experience of any individual whereby he learns successfully to carry on a gainful occupation. No one thing is more important in the industrial, commercial, and civic development of our great city than the setting up of educational facilities which will provide trained and efficient workers and craftsmen for the work which Baltimore has to do. And further, the obviously more important consideration is to provide education for all of our boys and girls — educational work which they can accomplish, which they enjoy and which will mean success for them educationally and vocationally.

The new deal in education presupposes an equal opportunity for all. This means an opportunity to get the best possible education and also an opportunity to prepare for a worth-while occupation. For many, vocational education is the superstructure of training for a job, but for a very large number of our boys and girls it is the major part of the foundation as well as the superstructure, because it must first provide the general education upon which to build vocational preparation.

Vocational education is a co-operative enterprise embodying the active participation on the part of parents, students, employers, labor, the community, and the schools. Many factors are involved in a satisfactory and efficient program, all of which must be carefully considered, properly evaluated and welded into a working system of education and training.

History of Vocational Education

Vocational education is one of the oldest forms of education. The early Jewish law placed the duty of teaching a trade upon the parent and it is significant that the earliest records of apprenticeship show the same relationship between master and apprenticeship. In the Babylonian code of Hammurabi about 2250 B.C. we find the following:

"If an artisan take a son for adoption and teach him his handicraft, one may not bring claim against him. If he do not teach him his handicraft, that adopted son may return to his father's house."

And so on through history from the early days up to the present time we find outstanding examples of various and many phases of vocational education. There are many instances of vocational programs dating back as far as 1642. Among the early programs of industrial education we find provision for such in the Massachusetts Ordinance of 1642. The Mechanics Institute Movement which was followed by the American Lyceum in 1824, has continued in revised form up to the present time. Such work was not generally recognized by the American public schools until about 1876, when an exhibit of the Imperial Technical School of Moscow attracted considerable attention. One of the very earliest schools about this time was the Baltimore Manual Training School which was established in 1884, that is, 50 years ago, and is claimed by many to be the first educational institution in the United States to establish manual training as a part of the public-school system. The Baltimore Polytechnic Institute, as this institution is now known, is of national significance. While it prepares more specifically for college entrance, many students enter directly into industry from the education which they receive there. This was the beginning of industrial and technical education in this city.

Commercial education, another important phase of vocational education, began with a course in penmanship in the Baltimore City College in 1850, 84 years ago. Three years after that bookkeeping was introduced into the curriculum but a complete commercial curriculum was not offered until 1891, or 33 years ago. Home-economics education, which is often referred to as a new phase of education, was urged by the more progressive citizens of the community about the time of the organization of the Baltimore Manual Training School. It was, however, not introduced until 1892. At that time there were 9,292 girls enrolled. Foods and cookery has been part of the public-school program for a period of 30 years. Vocational and educational guidance, which has been in existence for many years in the United States, was not provided for in Baltimore until September, 1923.

The Vocational School for Boys was organized in 1918 soon after the passage of the Smith-Hughes act creating federal aid for vocational education. Although printing was offered in 1918, the Ottmar Mergenthaler School of Printing was not opened until 1923. This school was the result of several years' work on the part of leading industries in this city. In 1920 a petition was presented to the board of school commissioners asking that a central school be established giving boys an opportunity for training in the printing trades. The Girls Vocational School was opened in 1925. In this same year the Vocational School for Colored Boys was organized, and the year following, vocational work for colored girls was provided.

Vocational Education of the Future

Vocational education, if it is to fulfill its obligation, must be continually adapted and readapted to prevailing social and economic conditions. It is consequently dealing with an ever-changing situation, and is constantly facing new and special problems. Vocational education has attempted to take into account the important social, economic, and industrial changes that have been proceeding steadily during the past decade or two and to plan accordingly. The recent emergency caused by a period of economic stress has accentuated many conditions thus forcing an immediate recognition of many problems. Vocational education must continue its present program in conformity with industrial progress and also to recognize social and economic changes and plan to assist in the new deal in education. There are, therefore, important changing conditions in vocational education.

There is turmoil, discontent, dissatisfaction, and discourage-

ment everywhere. Youth must be encouraged to go forward, to think logically and constructively. A change in attitude and the development of courage, confidence, and interest in worth-while things is essential. Failure in education must be eliminated in order to avert failure in life and to prevent idleness and delinquency. A suitable educational program for every boy and girl must be our goal. By this is meant educational work which can be successfully achieved and work which is pleasant, interesting, and in line with one's likes and desires. A widened and extended vocational program with many levels of achievement will meet the needs of a majority of our youth.

Young people of every aptitude and ability must be trained so that they can get a job and hold it. This will certainly reduce unemployment of the future. Adults will require short, intensive, and efficient vocational-training courses under appropriate conditions, whether employed, unemployed, or about to become unemployed because of social, economic, or technological changes. Thousands of persons, both youths and adults, will have to secure vocational training if they are to become employable or perchance to maintain their employability. This is a challenge to our entire school program and we should plan to meet the various educational needs of today and tomorrow. More than 90 per cent of our boys and girls will receive their preparation for making a living through public-school training.

Determining the Facts

We must face the facts. It is necessary to know each boy and girl intimately. We need to know the number who can profit by a proper program of training. The withdrawals, the failures, and the misfits command our attention and require our most careful study and consideration. It is also necessary, in some way, to determine accurately the number of adults desiring training as well as those who need it, but for various reasons are not willing to look after their own welfare. Their needs as to education and training will have to be carefully ascertained. Only in this way is it possible to determine the training need. This requires research and survey service not now in existence.

Other important and necessary facts in dealing with this problem of education are:

1. The probable requirements of industry, commerce, and other fields of work for trained employees by occupations.
2. The requirements of each occupation as it relates to age, mentality, education, training, and personal characteristics, if any.

The above facts can only be determined by a scientific survey of the workaday world conducted by a staff of trained workers. In addition to the original survey it will be necessary to set up machinery to keep such data complete and up-to-date.

Individual Differences of Youth

During recent years a great deal of attention has been given to the differences that exist among school children. It is a well-established fact that all boys and girls cannot succeed in the traditional school subjects. This does not mean that boys and girls who fail in the regular grades can succeed in the present vocational school. There is, however, every reason to believe that every boy and girl can master, in a more or less degree, some kinds of educational work. This is the task for the school department to determine. Vocational education of some level must be found for every individual.

In arriving at the proper vocational objective for each student it is necessary to take into account mentality, age — both chronological and mental, grade level, achievement level in previous school subjects, teacher's judgment, aptitude, interest, desire, physical stature, and for certain vocations personality, appearance, and other characteristics. This presupposes specific but different requirements for each vocational course and consequently for each occupation. This consideration, which needs more scientific procedure, is another part of the new deal.

The New Vocational-Education Program

The vocational school of today faces new conditions and new objectives. In addition to well-developed skills, occupational knowledge, vocational intelligence, and ability to do constructive thinking are required by present-day industry and commerce. The time has passed when book knowledge alone is sufficient equipment for a person for service in modern industry. Specific vocational education is needed to supply and improve workers to meet the present-day needs. It is not only necessary to know "how" to do a job satisfactorily, but it is essential for the highly skilled craftsman to know "why" a job is done in order to fully understand the scientific characteristics and the underlying principles of operation and to possess the technical knowledge of the work.

The vocational schools of Baltimore provide the upper vocational-training level. The majority of the present courses require that students have a good general school background and often more maturity than is now the minimum requirement. On the lower level we have the prevocational schools. There is a gap between these two levels which it is necessary to fill. It is proposed to establish immediately above the prevocational level, junior occupational schools to which pupils from the prevocational schools may be promoted after completing that level of work. From the junior occupational schools they may advance to the vocational schools provided they have satisfactorily completed lower levels of work. Chart No. 1 illustrates this proposed development. Students from the regular grades may enter the vocational type schools at the grade level indicated on the chart, provided, of course, that they satisfy the specific requirements for the course desired.

Rising Age of Employment

The compulsory school laws of Maryland permit boys and girls 14 years of age, who have completed at least the sixth grade, to be employed in various occupations. Employment standards as set forth in NRA codes prevent the employment of boys and girls at all until they are 16 years of age, and in all occupations where machinery or mechanical equipment is used, up to the age of 18. These conditions have tremendously changed the school problem. To claim that all of these people should go to the full-time traditional school evades the question. A new deal in education is necessary if this formerly employable group is to be served profitably.

Current conditions in employment also serve to restrict the employment of youth under 18 years of age, wholly independent of the operation of the NRA codes. In many instances employers naturally prefer to hire available adults for a job at standard wages. The result is that the young person who wants a job is unable to find one. This means that large numbers of boys and girls who formerly have been employed will be compelled to attend some sort of full-time school or spend their time in idleness. The vocational program must be enlarged and expanded to provide for this situation.

The trend in employment of workers according to ages, in four general classifications, is illustrated in Chart No. 2.

Chart No. 3 indicates the probable employment levels for boys and girls leaving our traditional and vocational schools. Through experience and additional training and education many will be able to move to higher employment levels. Many others, because of lack of ability or other shortcomings, will become the laborers and fill adult unskilled jobs as they go beyond the age limits of 19 in the lower employment level and 25 or 30 in the routine or operative level of work.

The New Apprenticeship

The history of apprenticeship, from the time when the father taught his son a trade, through the period of inden-

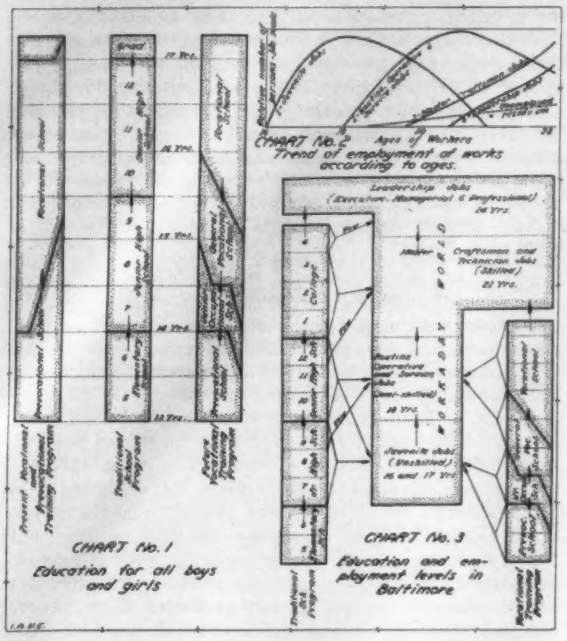


CHART No. 1
Education for all boys and girls
CHART No. 2
Trend of employment of workers according to ages.
CHART No. 3
Education and employment levels in Baltimore

ture apprenticeship with a master craftsman as instructor, to the so-called modern apprenticeship with little or no training except by the observation or "pick-up method," shows a progressive decline in values accruing from modern apprenticeship training. There is need for a new scheme of apprenticeship.

With a wise vocational program of education it is possible to provide the necessary skills and trade knowledge through courses taught according to scientific methods by experienced men trained in proper education procedures. An adequate course of study for each trade, covering the conditions of labor, acceptable educational techniques and procedures, and full technical content, can be developed only by the co-operation of the three agencies concerned — industry, labor, and education. Educators are agreed that through the vocational-school program, in addition to acquiring manipulative skill and knowledge of the fundamental principles of occupations, the student should learn to meet actual situations; to appreciate social, civic, and moral values; to overcome prejudice against manual labor; and to realize that attitude toward work is as important as aptitude.

A review of the census for 1930 discloses the fact that approximately 50 per cent of the working population of Baltimore is employed in the trade, manufacturing, and mechanical industries. There are in the schools of Baltimore more than 125,000 boys and girls, a large percentage of whom will engage in trades and mechanical kinds of work if they are to find employment in this city. This group must be guided, directed, and given training which will assist them to enter various occupations.

President Roosevelt under date of June 27, 1934, issued an *Executive Order* titled, "Prescribing Rules and Regulations for the Interpretation and Application of Certain Labor Provisions of Codes of Fair Competition as They May Affect Apprentice Training Programs in Industry."

It is now possible under this order to develop a nation-wide program of apprentice training. Committees are being organized in each state to develop the local programs. The Maryland program will require definite school training which can be met largely by the vocational school. This will mean a program of wider scope than that now in operation and must be of such character as will make it possible for apprentices to reach a recognized level of knowledge and skill and meet employment standards.

Parental Interest and Support

In the new program of vocational education, which calls for a wide range of training levels, it is necessary to interest parents and obtain their support, especially, as the program of education refers to their boys and girls. There must be an understanding of the requirements which must be definitely established at each educational level. This has been quite clearly established for the traditional school program.

Just as at present, where students reach their level in the regular grades the same condition will naturally prevail in the vocational-school set-up. A student cannot go to the senior high school before satisfactorily completing the junior high school. As far as the vocational school is concerned, students will have to complete the general vocational-school work or an equivalent level in the traditional school before being admitted to the vocational school. In this program boys and girls will, for many reasons, terminate their education at various levels.

Employer Participation

No program of vocational education can be complete or satisfactory without the interest, co-operation, and assistance of employers in the various occupations.

One of the most encouraging factors in the development of a program of vocational education in Baltimore has been the very marked improvement in the co-operative relations with organizations and individuals representing the various types of industrial and commercial employment. The Baltimore Association of Commerce and the Engineers Club have been very active in helping and developing an extensive program of vocational education. The Baltimore Typothetae and the printing industry in general have continued their good work in relation to the Ottmar Mergenthaler School of Printing. The Master Plumbers Association and the General Automotive Dealers Association, and associations representing the electrical and machine trades, have agreed to assist in the development of work for their craft.

Provision has been made in connection with many of the trade programs for a trade advisory or apprenticeship committee. The value of such an advisory group is invaluable. The committee is ordinarily made up of one to three delegates from each of the following organizations: master or employer organizations, journeyman or employee organizations, department of education, and manufacturers, jobbers, material and supply dealers. The work of such a committee has to do with determining the need for training, formulation of rules and regulations, enforcing part-time school attendance and regulation of apprentice publicity, review of student applications, approval and enforcement of apprentice contracts, maintaining contact with co-operative organizations, and similar matters. It is planned to extend the trade-advisory-committee idea to include every vocational course offered.

Co-operation with Labor

A program of vocational education is not complete without the support and co-operation of labor organizations. They are needed in planning the program, for counsel and advice at all times as to content of courses, and for their aid in the placement and supervision of young workers.

The American Federation of Labor has for many years been favorable to vocational education. They have developed a definite policy and have assisted in promoting vocational education on a national scale. At their convention in Norfolk, Virginia, in 1907, a resolution was passed in which they went on record as favoring the best opportunities for the most complete industrial and technical education obtainable for prospective applicants for admission into the skilled crafts of this country. They have been very active since that date and have taken a very prominent place in vocational-education history. Through the efforts of the American Federation of Labor, the Smith-Hughes Bill providing Federal aid for

vocational education was passed by the House of Representatives and Senate in February, 1917. This bill became a law with the signature of President Wilson on February 23.

The American Federation of Labor, at their meeting in Los Angeles, California, in September, 1927, and many times since then, reaffirmed their belief in an adequate program of vocational education under public control. They have gone on record to support and co-operate in the development of such programs and stand solidly for the maintenance of the standards of the trade and for the proper selection and further training of those preparing to enter the trade, as well as for the widest opportunity for those already employed to secure additional education and training at public expense.

The *American Federationist* of August, 1932, in an article on "Adult Education" says:

> Fifteen years of experience on a nation-wide basis have conclusively demonstrated the great value of this program of vocational education. Any continuing program of vocational education on a public basis should preserve such a standard in providing education to assist employed workers to become more efficient on the jobs which they hold, to become more versatile so that they may be able to work at various phases of their trade rather than as single-purpose workers, or to prepare for eventual promotion in the same general line.
>
> Such workers are more adaptable to being shifted from one job to another in the organization, thus lowering labor turnover and stabilizing employment. The local community, the state, and the nation are all benefited because of the increased knowledge and skill of their workers, with the resulting tendency toward stabilization of employment and the all round improvement in citizenship which is bound to result from having fewer incompetent or partly competent people floundering from one job to another. To the extent to which adult workers take advantage of the opportunities provided in the evening school to upgrade themselves and become more resourceful and better qualified in their occupations, they are protecting themselves against the loss of their jobs due to technological advances in their occupations. It is one of the primary functions of the evening school to render this sort of service. This program, through providing the instruction which assists people to keep up with new developments in their occupations, is rendering a great service to many thousands who might otherwise become technologically unemployed.

Baltimore apparently is forcing a new day. Labor is taking more interest in vocational education, and the new president of the Baltimore Federation of Labor has offered to co-operate with us in the carrying on of our vocational work. This means a new deal for youth and greater prospects for adult workers in the way of education and training for work.

Guidance and Adjustment

Guidance for students desiring to enter and for those already enrolled in vocational schools is as important if not more important than guidance with students pursuing work in other schools. There are many facts to consider with respect to the student and the course he desires. A careful and continuous check of his record and achievement in the vocational school must be made as he progresses through school. Adjustment of his educational program is often necessary. Many other problems affecting his schoolwork must be given thoughtful consideration. It is also often necessary to make a transfer to another more suitable course or even another school. This is the job of a specially qualified counselor.

Much attention is given to particular types of students for particular kinds of work. Attendance at the vocational schools is voluntary. Students are not required to go to these schools. They go with the consent of their parents after careful consideration has been given to the specific type of education in which they are interested. The question of grade, age, size, personal characteristics, likes, aptitudes, and inclinations are all taken into consideration at the time the matter is discussed with students desiring to enter vocational courses. During the 16 years the vocational school has been in operation we have accumulated a great many facts which are of great importance at this time. While tests are not used for the selection of students, they are used to check aptitude, progress, and achievement. Results show, however, that we could predict with reasonable accuracy the success or failure of at least 90 out of every 100 students entering this school.

A more extensive program of guidance must be provided for every type of vocational school. As tests become more reliable they will be of great value in determining aptitudes for specific courses. Achievement tests of the future will be an aid in checking trade-preparation progress. All of these factors, as they relate to students, will be vital parts of the guidance program.

Training and Retraining for Adults

Vocational education for the trades and industries and the home, as well as for commercial employment, must be provided on a larger scale for adults in the evening schools. Special classes must also be organized for adults in the late afternoons and on Saturday mornings when the school facilities are available. Our adult-training program is small and not sufficiently diversified. Men and women who want additional training and education should be given the opportunity. Incompetent and mediocre workers should be awakened and urged to increase their knowledge and improve their trade skills. A change of attitude toward better work is essential. Postgraduate courses for craftsmen are as greatly needed as are postgraduate courses for men employed in professional occupations. With the co-operation of employers such as we are getting from many organizations at this time, it is felt that all of this work will become more valuable each year.

In this country we have been in the throes of a period of unemployment. With the economic depression came the discharge of workers. The workers who were least capable were the first to be released from the payroll. Without training for definite employment, the unemployed will find it difficult to get work even with the return of better conditions. In fact, it is quite probable that many of them will remain unemployed until they prepare themselves to do kinds of work which need to be done. For the worker of tomorrow and the adult of today, it is then actually necessary that consideration be given to immediate provision for courses of training which will combat this phase of the unemployment problem. Vocational education will not solve unemployment, but unemployment cannot be solved without vocational education.

The point is wisely taken that we pay a big price for modern science and invention. Automatic machines and labor-saving devices in industry have replaced men in large numbers, but new inventions and new industries require new trained workers. New types of work and new services to be rendered must be found. For many kinds of work, such as auto mechanics, because of the changes in design and mechanical complications, more highly skilled mechanics are needed. The manufacture, installation, and service of the radio equipment require skilled men. This is true also of electric refrigeration, oil-heating systems, air-conditioning installations, and other kinds of products and services. Workers displaced by modern advances in industry can, therefore, readily change over to new occupations provided a proper program of retraining is at hand. Unemployed workers are entitled to this educational opportunity to adjust themselves to those new demands of industry which require new skills, new techniques, and information.

Effect on Juvenile Delinquency and Crime

The cure for delinquency and crime is to prevent it. Wider constructive work is needed with respect to the prevention and elimination or at least the reduction of delinquency and crime. Reliable authorities assure us that the type of delinquency which leads often to crime is the direct result of lack of preparation for definite employment. If this be true, our schools are challenged to provide a variety of educational courses in order that all boys and girls may be specifically

trained. Vocational education, therefore, becomes one of the sanest and most effective of remedies.

Mr. Harold E. Donnell, formerly Superintendent of the Maryland School for Boys and now Superintendent of Prisons in Maryland, writes as follows:

I am thoroughly of the opinion that there are many boys of the nonverbal type who can be taught to work with their hands and possibly given a certain elementary training which will enable them to get on in life. The doing away with the apprentice system in the trades and the further taking of work away from this type of boy by action of child labor laws has placed a great many misfits in society. Naturally, a great many of these cases become delinquent and later on fall into crime, while others become merely dependent problems. I thoroughly believe that more emphasis should be placed on manual and vocational training in our public-school system and that the greatest emphasis should be placed upon those of limited intelligence, or perhaps better stated, upon those who have no inclination toward the regular academic routine.

Brother Benjamin, Superintendent of St. Mary's Industrial School, Baltimore, knows whereof he speaks when he says:

Vocational training helps materially to lessen delinquency because you place an objective in the mind of the boy and in practically every case the boy will fight manfully to attain the goal which his objective promises. It also gives him an opportunity of acquiring a position, for employers the country over will prefer to employ the experienced boy rather than the beginner.

We can well afford to consider also the opinion of Dr. Walter N. Thayer, Jr., formerly Superintendent of Prisons in Maryland and now of New York State, an outstanding authority on delinquency and crime. In a recent communication, he writes as follows:

One of the striking characteristics of the inmates of prisons and reformatories is the lack of ability to perform anything in the way of skilled labor. One rarely finds even semiskilled artisans in these institutions. There seems to be a rather close correlation between academic education, skilled craftsmanship, and ability to get along in civil life. I am convinced that if we would identify these cases sufficiently early and substitute manual or vocational training for the academic, we would keep many of these boys out of trouble later on in life.

The Congress of the United States has agreed that the prevention of crime must begin with young people. Senator Copeland's report shows the average age of criminals to be 23. The largest group is 19 years with the next largest group 17 years of age. With an appropriation of $70,000 the Washington school system has set up an experimental program of character education looking to a discovery of facts bearing upon juvenile delinquency. The experiment will be watched with interest. The schools can, no doubt, render valuable service in this most important social condition.

The vocational school should always endeavor to discover and develop proper character traits, attitudes, and habits in all its students. These characteristics are fundamental in all of life's activities, and contribute greatly to success in the world of work.

Leisure-Time Activities

It has been stated by a reliable authority that with the return of prosperity and maximum employment, even to a peak time like 1929, from 6 to 8 million people, who are willing to work, will be unable to find employment. This is largely due to invention, which has continued unabated during the depression and to new technological changes in industry. This does not include about 2 million who have always been unemployed, nor does it take into account the fast approaching short work week. Millions of people will have lots of leisure time.

This is a sure indication that the vocational school, as well as other schools, should encourage preparation for leisure-time activities that are worth while. Athletics and recreation should be in every student's program. The reading of good books and magazines should be emphasized. Hobbies of many varieties will grow out of vocational training, particularly handicraft work and the home shop. Music should be included in the vocational-school program. Civic responsibility and welfare activities can well be developed through student government and welfare within the student body. This whole matter is a vital one so far as the worker is concerned.

Certified Workers

From practically every professional vocational school, students are turned out with a stamp of approval of the institution, certifying them as being able to carry on in the field of work for which they have been trained. This is true in medicine, law, and engineering. A great need at the present time is for a vocational program of less than college grade from which students may be certified as being able to carry on in the various trade, industrial, and commercial occupations of the city. This, of course, will require a real program of training, but it is both feasible and possible.

Pride in craftsmanship needs to be stressed in order that craftsmen may take greater interest in doing better work and not keep ever uppermost in mind the almighty dollar. To keep pace with the changing industrial conditions, the dignity of labor should take a more prominent place in the discussion of employment in the trade and industrial occupations. People have altogether too long considered the mechanical and industrial occupations as being employment requiring inferior minds. It is very evident that occupations in this field require minds far superior to those required in many other lines of endeavor. Considering vocational education from every angle, it is quite easy to see that this type of education, which fits both for life and for livelihood, is as important, if not more important, than any other type of education. The future of this great city depends upon trained men and women.

Placement and Follow-Up

Placement and follow-up is an important consideration in any vocational-school program, as it is for all education. The time will surely come when it will be the responsibility of departments of education everywhere to see all students into their next step in life, whether it be into a college or into the workaday world. The youth of today must be helped to secure the kinds of work for which they are best qualified and occupations in which they will be most successful and happy. This involves not only the finding of that job, but involves close follow-up by a co-ordinator for a year or more in order to determine whether the individual in question is satisfactory to the employer and is happy and contented. Satisfactory placement and follow-up work is a difficult job which requires the services of specially trained placement workers. They must be thoroughly familiar with conditions and requirements in the various fields of work. They must also be skillful salesmen, tactful and conscientious. This work must be carried on scientifically. It will be an added expense to the schools but a decided asset to society and the community. Successful, satisfied workers are our best and most valuable citizens.

Educational Investment and Costs

The cost of education, provided the money is carefully, judiciously, and properly spent, is the best investment any community can make. School costs, however, are always under fire and constantly challenged. Vocational education as its part of education's new deal is attempting to show results that are worth all it costs and more. Classes have been greatly enlarged, thus reducing the cost of instruction, and the expenditures for supplies and materials have been considerably curtailed even to the point of lessening the efficiency of the work. The annual cost of education of a student in one of the Baltimore vocational schools is now no larger than the cost of a student in a technical-high-school program.

Money spent for vocational education should produce re-

sults. Failing and repeating students are promptly transferred to more suitable courses where money will not be wasted, thus avoiding double or enlarged costs. Our vocational-school graduates have been unusually successful in finding employment as a result of their training. They therefore become a community asset.

New schools and new types of education will cost money for equipment and educational materials, but the cost of instruction will not be increased because it will require no more teachers in the system. It will surely mean greater returns for the money spent because of successful rather than failing work on the part of pupils. No one can estimate the saving to the community because of the probable elimination of delinquency. Nevertheless it is an important factor.

In 1933 the Federal Government appropriated approximately 8 million dollars for aid to vocational education in the various states. Baltimore received about $15,000 of federal and state aid for vocational education that year. The new George-Ellzey Act, which was passed by the last Congress, should give Baltimore from $10,000 to $15,000 additional aid this year. The State of Maryland reduced their vocational appropriation from $25,000 to $9,000 in the last budget. Every effort should be made to secure an appropriation for vocational education in Maryland of at least $50,000 annually. Our state has been very dilatory in properly providing funds for this type of education.

The new deal will require more money if it is to be successful, and some way, somehow, this money must be forthcoming.

Industrial-Arts Research

William E. Warner

Ohio State University,
Columbus, Ohio

This article is based on an address made before the research section of the Western Arts Association at its convention in Detroit on March 23, 1934.

THIS topic always interests me (85)[1] because it requires an extensive organization of the perspective one has concerning the progress and future of his field. One's initial and obvious assumption is that progress in industrial-arts education, as in any field, is, or certainly should be, in direct relation to research accomplishment. This indicates something of the significance of the topic. No shop teacher, then, can afford to be inactive as regards research and the progress made possible by the completion of valid studies. It may be well first to review what work in research has been sponsored and accomplished in industrial-arts education by some of the associations.

Research in the Associations

The Western Arts Association has stood out among the various associations for certain studies it has sponsored in times past. One of the first of the significant ones was reported in the 1907 *Proceedings* and had to do with "Credit Allowances for the 'Special' Subjects." Ten years later, in 1917, Ira S. Griffith's reports on "Standards and Tests" began the investigation and study of two topics in the industrial-arts field which have been carried on ever since. *The Terminological Investigation* reports initiated at the Cleveland convention in 1929 were concluded with a final report in St. Louis in 1932 and by a special symposium monograph published in 1933.

An inspection of Proceedings of the National Education Association as far back as 1900 does not reveal any sponsorship of research pertaining to industrial arts. The same can be said of the American Vocational Association since its inception at Louisville in 1926, although reports of an empirical nature have been published on "standards" in addition to certain ones which were brought out by the old National Society before that time.

The Mississippi Valley Conference consisting of persons engaged in the preparation of shop teachers will celebrate its twenty-fifth anniversary at Peoria, Illinois, in December, 1934. This stimulating conference of college and university people has made certain reports in its history on research topics in Industrial Arts, some of which were produced in the form of "leaflets" (82) by the United States Office of Education when Dr. William T. Bawden, as conference chairman, was the government's senior specialist in industrial education. The conference has not sponsored any of the more complete type of printed reports until this year with the production of an anniversary volume (54) which should have considerable value for the profession. An interesting publication from a committee of this group is a list of 800 theses and dissertations (44). Several people co-operated on this study, which was directed and produced by William L. Hunter of the State College at Ames, Iowa. It provides a valuable catalog for reference and is a revealing index of research accomplishment in industrial-arts education.

Available records of the Eastern Arts Association do not reveal any reports of researches in the industrial-arts field, but there are a few state association reports of interest. These are to be found in connection with the work of the Michigan, Illinois, and other state vocational associations.

Epsilon Pi Tau, the national honorary professional fraternity in industrial arts and vocational industrial education, founded in 1929, is outstanding thus far for its professional yearbooks, begun in 1930. Its 1930 *Review* included certain noteworthy bibliographies, particularly a rather complete one of 92 Ph.D. dissertations in, or directly related to, industrial-arts education. The 1931 *Review* included an unusually significant symposium of fourteen chapters on *Industrial Arts Testing*. The table of contents of this much used and widely quoted study may be seen on page 43. The 1932 *Review* included the results of a three-year study on the fraternity's constitution, and the 1933 number carried a symposium study on the whole question of *Standardization*. The 1934 *Review* contains an unusually interesting and significant study on *Public and Professional Relationships;* and the 1935 *Review*, already planned, is to be devoted to the whole question of *Research*, where one of the more important chapters will be devoted to the question of *bases for evaluating research* in industrial-arts education.

The discouraging thing is that the industrial-arts profession, to my knowledge, has never had a full-fledged research bureau, a full-time research worker, or any subsidies of more than one hundred dollars a year for research. A few of the leaders have outlined programs and made timid suggestions and requests, but that is just about as far as the thing has gone.

With these reports as a beginning, it is professional to ask, "Should local, state, regional, and national associations which are supposed to represent the interests of industrial arts, sponsor programs of research and resulting publications in the light of the assumption stated in the opening paragraph? What is your answer?"

Certain Prerequisites for Research

No discussion of *needs* and *accomplishments* of industrial-arts research would seem to be complete without an early

[1] A number within parentheses refers to the corresponding number in the Bibliography at the conclusion of this article.

review of certain items which go along with the production and use of research. These may be referred to as prerequisites, because they do seem to be essential parts of anyone's professional and intellectual equipment who expects to do or use research.

As a start, one should have a desire for and possess a fine attitude toward general and specific scholarship. Teachers frequently drift into professional ruts by not being continually on the lookout for all types of literature that report findings and progress relating to industrial-arts education. One is agreeably surprised occasionally, for example, when he finds that significant progress is made for the industrial-arts profession by specialists in other fields. Many notable and very useful contributions have come from psychology, physiology, economics, engineering, elementary education, secondary education, guidance, administration, sociology, history, and certainly philosophy. One cannot afford, therefore, to be out of touch with what is accomplished in these other fields, including, of course, work in the finer types of arts and crafts wherever they are found.

The question of scholarship cannot be acccomplished with any great degree of facility unless one is constantly on the lookout for new publications. This usually results in the accumulation of a good professional library, the contents of which the research worker must be familiar.

The next item in the way of prerequisites is for the researcher to become acquainted with the contemporary problems in his field in all sections of the United States, if not the world. *Research and graduate work assumes a certain measure of leadership in one's profession,* and this involves knowledge of the problems of the profession if the worker is to have a desirable background and make much progress.

Considerable practice and experience need to be gained in thinking both objectively and abstractly. This is one of the first requirements of graduate work and research, and is something which all too few people accomplish. Much trouble is in store for the aspirant who cannot master these abilities. A rather elementary but important requirement is that one must learn to identify, count, assemble, classify, read, quote, interpret, chart, and write with proficiency — all before he can expect to make even a good start in research. Many have the mistaken notion that they can do research when they have made a count or chart of something.

One should develop a wholesome but intense curiosity and along with it a strong desire to find an answer to the problems which he sees. Such things as intellectual honesty, impartiality, and patience, however, all go along with curiosity and a desire for accomplishment. The emotions certainly have no place whatever in research.

It is always essential to study the work and accomplishments of men in positions of leadership. Progressive movements or departures can always be traced to the initiative and work of a leader.

One of the best ways of identifying or characterizing a study as a research is to discover if its results show the application of valid techniques. Three examples are now presented both to illustrate the use of techniques in research and to familiarize the reader with the ways in which topics or problems are developed. The first is an example which shows the application of several techniques. The illustration is taken from the Western Arts Association's *Terminological Investigation* (88).[2]

The Question of What Professional Term to Use. The following points in the development of this interesting research report were used as chapter heads:

1. Inception at Cleveland in 1929.
2. Evidences of Confusion Indicating Need.
3. Scientific Approach to the Study.
4. Compilation of a Master Word List.
5. Etymological Study of Words in the List (Hutchinson).
6. Comparative Study of First Use (Bennett).
7. Studies of Contemporary Usage (Bollinger):
   a) by 358 Ohio shop teachers,
   b) by different organizations and places,
   c) by authors and periodicals.
8. Generic and Other Relationships.
9. Psychological Implications (Bollinger).
10. Philosophies Being Labeled (Warner).
11. Synthesis of Findings Presented in a Glossary.
12. Reactions of Critics (Bawden and Gribble).
13. Establishment of Machinery for Dissemination.
14. Appendices: A Bibliography and the Master Word List.

The second example shows the application of but one principal technique and is *a suggestion for a study* which a committee of the Western Arts Association's council now has under way. It concerns a revision of the association's constitution and involves a preliminary but basic analysis of certain *functions* of and relationships in the Association's work.

Revision of the Association's Constitution

1. Administrative.
2. Public and Professional Relationships.
3. Convention Program and Publicity.
4. Research and Editorial.
5. Exhibits: Educational and Commercial.
6. Membership.
7. Budgetary and Audit.
8. Secretarial and Treasury.

The third example is of an unusually interesting study in the industrial-arts field, completed in 1933, which may be described as a *technological* type. The study had to do with *School-Shop Noises* and involves an investigation of their nature, effects, and reduction. It was done by two graduate and experienced engineers who completed their masters in industrial-arts education: Erick B. Berglund, now of Ely, Minnesota, and William R. Fiedler, of the Heald Machine Tool Company of Worcester, Massachusetts (10).

School-Shop Noises. The table of contents of this thesis reads as follows:

1. The nature of "noise."
2. The ear or human-hearing apparatus.
3. Noise as a consideration in industrial-arts settings.
4. The thesis problem.
5. Measurements of noise.
6. Review of other studies.
7. Effects of noise.
8. Analysis of school-shop noises as to source, transmission, and absorption.
9. Noise and the teaching problem.
10. Digest of the findings.
11. Methods for reducing certain shop noises.
12. Recommendations for the school-shop planner.
13. Related problems.
14. Appendices: absorption coefficients and a bibliography.

The three examples just reported are provided for purposes of illustrating different techniques of research attack and particularly for purposes of helping the reader to catch the swing of a research treatment.

Typical Groups of Research Techniques

It is natural, after a preliminary study of the application of certain techniques of research in studies like the examples shown, for one to ask himself concerning certain large group classifications of research techniques, one or more of which would apply to a problem. The following classifications are presented to summarize the suggestions for techniques found in the three problems just described and to suggest a further analysis of this significant problem in all research studies — bibliographical, historical, philosophical, comparative (normative type), sociological, experimental, physiological, psychological, statistical.

The reader should not misunderstand this list by believing that these are the only techniques of research, because each of them can be broken down into many others. The experimental alone, for example, would likely involve thou-

[2]Copies of this 44-page report may be secured from the author or directly from the Association's Secretary for 10 cents in stamps.

sands of techniques. The statistical involves at least nine major classifications, and the comparative, as well as the sociological, certainly involves many, many more. It seems necessary to pause at this point, if the reader now thinks himself ready to do research, in order to catch another essential, namely, that of a professional perspective of industrial-arts education on at least one level, the secondary school.

One early catches the notion that *education about industry is one of the fundamentals in public education,* where the other fundamentals consist of studies concerning agriculture, commerce, and physical and health education, in addition to the so-called fine arts, which, of course, include music as well as painting, sculpture, design, and the like. It takes courage to present such a thought as a postulate, however, because

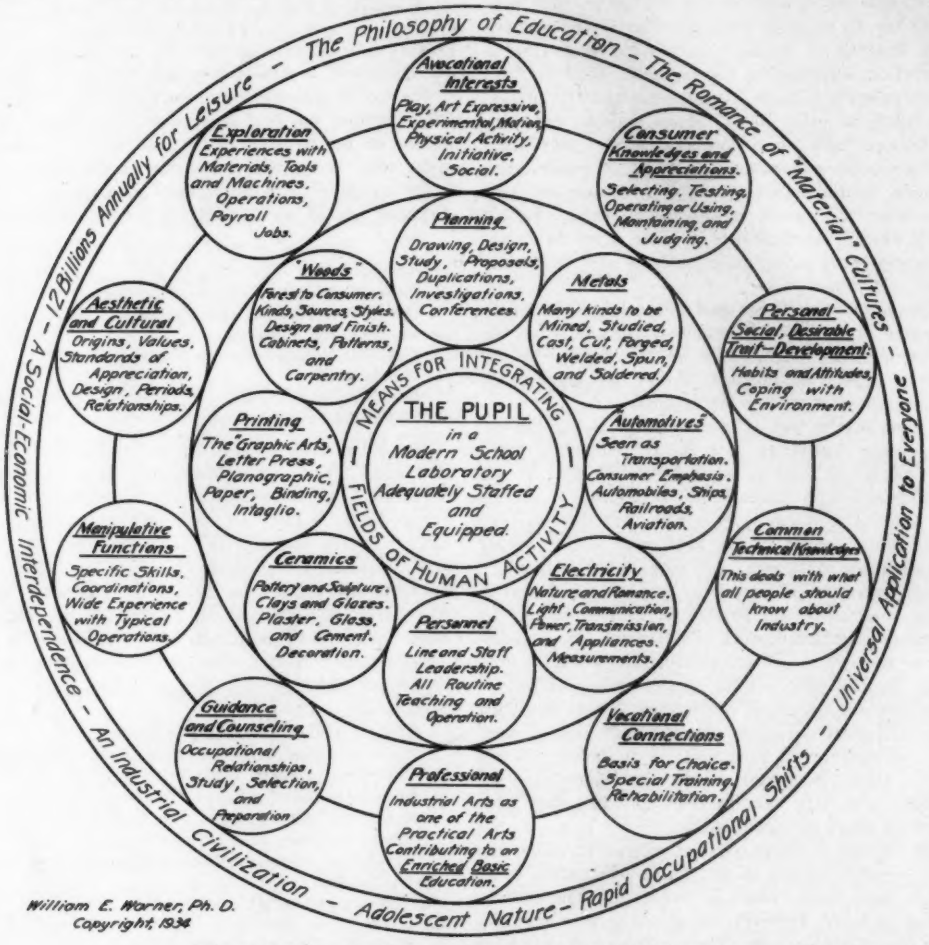

The Philosophy of Education - The Romance of 'Material' Cultures - Universal Application to Everyone - Rapid Occupational Shifts - Adolescent Nature - An Industrial Civilization - A Social-Economic Interdependence - 12 Billions Annually for Leisure
Avocational Interests
Play, Art Expressive, Experimental, Motion, Physical Activity, Initiative, Social.
Exploration
Experiences with Materials, Tools and Machines, Operations, Payroll Jobs.
Consumer Knowledges and Appreciations.
Selecting, Testing, Operating or Using, Maintaining, and Judging.
Planning
Drawing, Design, Study, Proposals, Duplications, Investigations, Conferences.
"Woods"
Forest to Consumer. Kinds, Sources, Styles. Design and Finish. Cabinets, Patterns, and Carpentry.
Metals
Many kinds to be Mined, Studied, Cast, Cut, Forged, Welded, Spun, and Soldered.
Aesthetic and Cultural
Origins, Values, Standards of Appreciation, Design, Periods, Relationships.
Personal-Social, Desirable Trait-Development:
Habits and Attitudes, Coping with Environment.
MEANS FOR INTEGRATING
THE PUPIL
in a Modern School Laboratory Adequately Staffed and Equipped.
FIELDS OF HUMAN ACTIVITY
Printing
The "Graphic Arts", Letter Press, Planographic, Paper, Binding, Intaglio.
Automotives
Seen as Transportation. Consumer Emphasis. Automobiles, Ships, Railroads, Aviation.
Manipulative Functions
Specific Skills, Coordinations, Wide Experience with Typical Operations.
Common Technical Knowledges
This deals with what all people should know about Industry.
Ceramics
Pottery and Sculpture. Clays and Glazes. Plaster, Glass, and Cement. Decoration.
Electricity
Nature and Romance. Light, Communication, Power, Transmission, and Appliances. Measurements.
Personnel
Line and Staff Leadership. All Routine Teaching and Operation.
Guidance and Counseling
Occupational Relationships, Study, Selection, and Preparation
Vocational Connections
Basis for Choice. Special Training. Rehabilitation.
Professional
Industrial Arts as one of the Practical Arts Contributing to an Enriched Basic Education.
William E. Warner, Ph. D.
Copyright, 1934

Chart showing significant relationships in industrials arts on secondary-school levels

Universal Need for Perspective

(Refer to the circle-chart analysis.)

It soon becomes evident that the research worker needs orientation as he considers his field for the purpose of choosing a problem. What are some of the problems which are available for him to study, and what is their relative importance? Also, what is the relationship between one problem or group of problems and another? Answers to questions like these should be of material help if there is any opportunity for him to grasp a perspective. There is the additional point that administrators and others are asking about industrial arts and its possibilities on *all* school levels. The observation is all too frequently made that industrial-arts people either do not or cannot talk about their field. The need, then, for perspective in industrial arts is seen to be a universal one and, of course, is particularly important as another prerequisite for research in industrial-arts education.

The accompanying chart is one person's portrayal of certain relationships which seem to have significance in industrial arts on secondary-school levels. The chart should be considered as *a synthesis of a philosophy in operation.* It certainly should be thought of as in motion.

of the stupid tradition and assumption that such obviously minor techniques as learning to read, write, and figure are conceived of as *the* fundamentals in public education as in former generations.

The outer rim of the circle chart suggests certain principal sources of the heritage of industrial arts. This leads directly into a set of professional objectives or formulations which, when broken down into their various meanings, or concepts, serve as specific criteria for controlling or evaluating whatever is selected and experienced as industrial-arts subject matter, all of which revolves about the pupil and naturally assumes a laboratory that is both adequately equipped and staffed.

The student of industrial arts, on inspection of a chart of this type, reflects that shopwork in American secondary schools has passed through two somewhat well-defined periods of professional growth and is now in the midst of a third. The first was "Manual Training" where the emphasis was on *hand* skill chiefly in woodworking. The second was "Manual Arts" where the emphasis, while still on skill, was extended to include the *making* of both *useful* and *well-designed* articles. The third is now "Industrial Arts" where

'the intent is to include all of the old that was good, but to broaden out from the limitation of an emphasis on *manual* work alone to an enriched conception where more of the child's interests and environment and certainly many of the school subjects are involved. This involves a general study of industry and its products along with a spread of manipulative experiences in what might be referred to as an organic program of useful education.

The rim of the chart shows several elements in a great heritage. Industrial arts is an unusually significant phase of general education. Americans have been able, according to the Hoover report (64), to purchase between ten and fifteen billion dollars worth of leisure each year. Five billions of this have been spent on things associated with the automobile. We live, obviously, in the midst of a great industrial civilization. Occupational shifts are wide and rapid. Such facts are inescapable and cause our program of education to differ vastly from that of even a generation or two ago. Ours is an interdependent society, and we are in a material world. Educated people are always intrigued with the great civilizations of former times, which invariably have been known for their material cultures. Such things endure even beyond history. These and other points indicate the need for a more flexible type of education. While such things concern all people, the particular thought here is what reference they have to the adolescent and to the high-school program of shopwork today.

Considerable attention is being given in the "new deal" to distribution and to the consumer, who more than ever needs to be "an intelligent chooser and user of the products of industry." There is also more reason than before to expect industrial arts to assist in the development of enduring interests in worth-while hobbies. Greater recognition is now given to design and the appreciation of great creations. Exploration also takes on new significance because of the myriads of new materials, resulting processes, and consequent jobs to be studied and experienced. There are so many more tools now which everyone should be able to use with facility. Think, also, of the multitude of technical things about industry which *everyone* should know. Then, the business of being a success involves the assimilation of desirable personal-social traits, many of which are easy to acquire in the setting of a school shop or laboratory when such is the intent. All of these and other possibilities direct attention to the need for developing industrial-arts work.

When once the nature of such a program is known, the next problem is to learn what subjects it should include. Nothing is without a plan in a material world. This suggests drawing, sketching, and duplicating, and involves both study and investigation to learn what is best for one to do. The world's great industries work with different woods, metals, clays, foods, textiles, and the like. Electricity is one of our greatest forces and is therefore significant for study in the modern school. "Automotives," when interpreted as referring to any self-propelled machine, includes a consideration of all kinds of transportation. All of these would be for naught, however, without the graphic arts, commonly referred to as printing.

Now the educator asks, "All this subject matter to what end?" The reply is found in studying the possibilities for integration where the child is the center of the picture in an adequately staffed and equipped laboratory. Academically, think of the possibilities for drawing the social, physical, and even biological sciences out of studies which deal with industry and material things. Socially, as has been indicated, people are interdependent in an industrial civilization. This is suggestive for both organization and method in a modern school shop. In the older days, no one ever thought of doing anything outside of the school, but now the laboratory is considered as a center from which the whole panorama of industry is seen as a field for study and participation by the pupil.

The relationships mentioned above are all to be found in the accompanying chart. It is important that everyone understand them if the possibilities of even an adequate program are to be achieved. Industrial arts is defined as but one of the practical arts where studies about agriculture, commerce, and the home are included as well. All of these are considered foundational today and become basic for later programs of specific vocational education which now begin at eighteen years of age and later. Industrial arts as described and shown here has been referred to as one of the "new fundamentals" because it not only deals with material things but with a phase of present-day civilization from which no one can or even wants to escape because of the richer and fuller life it has made possible. Now, what are the elements in this perspective?

The circle chart has been presented for consideration not only from the angle of what the industrial-arts specialist can or should say about his field of work, but for the purpose of discovering many problems for study. Suggestions of certain major groups of studies are now reviewed.

Certain Major Classifications of Research Problems

This discussion includes the following classifications: historical, philosophical, pupil, curriculum, methods and devices, tests and skills, organization, physical planning, nomenclature, teacher studies, supervision, teacher preparation, and administration.

Historical. The following accomplishments are selected from an unusually rich literature concerning the background of industrial arts, which might well be considered foundational to the research worker. There is Bennett's noteworthy first volume (6); his symposium treatment of *Historical Research* (9); Anderson's history (4); Salomon's splendid report (68) on the history and *Theory of Educational Sloyd;* Coates' report on De la Howe and his proposed manual-labor school; both Coates and Emerson on Woodward's school and the St. Louis development, in addition to Woodward's own writings (92); while Harms (38), Seybolt (70), Douglas (26), and Turner (81) have produced significant investigations on American apprenticeship. Richards (65) has written on the American and foreign museum. Sadler (67) and Edwin G. Cooley (20) have each published splendid reports on continuation schools; Royer (66) has covered the question of *Mission Education in the Southwest.* Kramer (47) has made an exhaustive report on *The English Craft Guilds;* and DeVette (22) on *The Dutch Craft Guilds.* Harper's translation of Hammurabi's Code (39) is a classic, and Dard Hunter's researches (43) on paper and paper making have been quoted at various times in sixty volumes. Carter's dissertation (16) on *The Invention of Printing in China* is an unusually significant document, and Benvenuto Cellini's autobiography (18) is an entertaining type of treatment of the life and work of the world's greatest goldsmith. Bower (14) and Phipps (63) have each contributed significant biographical researches, the first on Booker T. Washington and the second on Frederick G. Bonser. Glover and Cornell (33) have dipped into the background of American industries, and Neuburger (56) has done a comprehensive report on *The Technical Arts and Sciences of the Ancients.* Pugh and the writer (90) found 55 excellent references in English on period styles in furniture, in the library of the Metropolitan Museum of Art, along with many famous treatises on the nature and development of Oriental rugs, pottery, tapestries, glass, jewelry, silverware, lace, pewter, batiks, etchings, woodcuts, textiles, and the like.

The mature student of industrial arts pauses to ask what further historical researches — and the above is naturally but a partial report — are needed. The question is difficult to answer, because it involves a background which no one ever seems to know well enough. It may be that therein lies the answer. In any event, it is hoped that suggestions for further studies may be gained from this review of accomplishment.

Philosophical. There have been all too few studies of a philosophical type in industrial-arts education. Many ques-

tions might be asked, for example, which would be suggestive of studies, as: the nature and place of the aesthetic; the nature and amount of nonmanipulative work; the emphasis to be placed on leisure-time or avocational activities; the nature and significance of material cultures in world civilizations with their lessons for the American public school of today, etc. It is interesting to note a few references which seem to be basic:

Salomon: *The Theory of Educational Sloyd* (68).
Dewey: *Democracy and Education* (23).
Bennett: *The Manual Arts* (7).
Bonser: *Life Needs and Education.*
Bonser and Mossman: *Industrial Arts for Elementary Schools.*
Osburn: *Objectives Validation* (59).
The Kent, Hunt, and Osburn validation studies (46, 42, 58).
The 1927 study and formulation of Professional objectives (87).
The 1932 analysis of these Objectives for their Meanings, or Concepts.
The 1933 use of these Meanings as Professional Criteria for selecting and judging not only Content but Method as well. A whole realm of curriculum research and evaluation is opened up as a result.
Friese: 1933 List of Principal Concepts (31).
The 1934 Circle Chart of *Perspective and Relationships.*
Mumford: *Technics and Civilization,* etc.

All researches, whether the worker realizes it or not, involve certain philosophic treatments. These may be referred to variously as assumptions, postulates, theories, objectives, relationships, definitions, distinctions, functions, criteria, and policies. An expression or interpretation of practically all of these ten terms may be found in almost any major research. Many young writers, for example, will begin a study and develop it on a certain unstated assumption of which they are frequently not even aware. More mature research reports (61), however, state their conditions or assumptions and stay, if possible, with the undisputed ones called postulates. A development of these terms would require more space than is available here, but the reader may find excellent treatments of them and other points in any one of the more recent books on research.

The Pupil (social, psychological, and physiological phases). The early work of Stenquist (75) and Toops (80), in addition to the Minnesota study (61) of 1930, Strong's report (77) of 1931, and Thorndike's report (79) of 1934, may be pointed to as some of the more significant accomplishments in researches pertaining particularly to the pupil. There is great need for additional researches in industrial arts on pupil habits, skills, attitudes, appreciations, and certainly aptitudes as well as interests. Theses by Decker (21) and Miller (53) provide excellent examples of researches concerning the pupil.

Curriculum. The essential perspective here includes both a horizontal and a vertical analysis — horizontal in the sense of an *intensive* study of curriculum requirements on any grade, age, or school level; vertical in the sense of a general industrial-arts program from the preschool on up through regular school classes to adult leisure activities. The following may be pointed to as accomplishments of particular worth concerning the curriculum: Caswell (17) on what units to install, Friese (31) on curriculum construction, Hankammer (37) on the drawing curriculum, Hale (36) also on the drawing curriculum, McGee (51) on a foundational study, Newkirk (57) on a validation study, Patlow (62) on automotives, Sanders (69) on pottery, Strube (78) on farm-shop work, and Waldeck (83) on metal work.

When one considers research needs as regards the industrial-arts curriculum, he is often forced to ask if there is any technique or techniques which are particularly suited. This raises the old question of the advisability of using trade curriculum-making techniques for industrial-arts purposes. Many assume falsely that this can and should be done. Researches in method and philosophy, however, clearly point to the need for separate procedures.

If the reader thinks everything is certain and established without question as regards the industrial-arts curriculum, and if he still uses a term like *mechanical* drawing, he is asked to consider certain questions about this oldest of the industrial-arts subjects. Should an *engineering* conception control what is taught or should a *social* approach be used as in the industrial-arts drawing researches by Hankammer (37), Hale (36), Hauenstein (40), and Roberts? Should an analysis of the details of some machine, radio, or work of an architectural draftsman determine the content for industrial-arts drawing? No, of course not. Far different criteria control. Should one use the professional-criterion technique already referred to, or, is some one of eight or nine other well-defined techniques of curriculum research described by Bruner (15) the best approach? Until further work is completed in this phase of what is characterized as curriculum validation, can you discuss the various ramifications of the problem?

The foregoing indicates, partially at least, that the industrial-arts curriculum offers an unusually rich field for study, once a general scientific technique or related group of techniques has been established which will permit sound progress to be made. It should not be difficult to list over 100 problems in this connection from a study of the circle chart.

Methods and Devices. Very little work has been done on this topic until recently. Gunther (35) paved the way with a dissertation, and master's theses by Adams (1), Borofka (13), and Dickman (24) are noteworthy accomplishments. Dean Siepert (71), of the Bradley Polytechnic Institute at Peoria, Illinois, reports a summary of progress in method in the anniversary volume of the Mississippi Valley Conference. The following material is even more recent and has been made available for this article by Hoyt H. London, of the Ohio State University, who is now completing a group of studies on methods concerning the individual instruction sheet (49).

1. *Method defined.* London defines *method in general* as a way or procedure for going about a thing: *method in organization* as a schematic arrangement, e.g., the unit shop vs. the general or multiple-unit shop; *method in content selection* as a technique used in deriving content, e.g., child interest vs. logical subject matter; *method in instruction* as an approach to the teaching process, e.g., oral-demonstration-group method vs. individual-instruction-sheet method, or job-sheet vs. operation-sheet method, or project vs. production method.

2. *Three basic methods.* London reports on three methods employed in industrial-arts teaching on the secondary level: (*a*) the prevailing or traditional method of class demonstration and oral instruction. This is on the wane due to large classes, a changing philosophy concerning teaching and learning, and a shifting emphasis regarding purpose; (*b*) the individual-instruction-sheet method with the job or project as a point of departure is a natural adaptation of the Allen (2) technique of job analysis which uses the job sheet, later developments preferring to call it the problem, or lesson sheet; (*c*) the same as (*b*) but with the operation as the unit — an outgrowth of the Selvidge technique of analysis developed during the war in training technicians. These three methods are sometimes used in combinations as well as singly.

Examples of publications using the *job-sheet* approach include: Butler and Petersen on metal work; Bedell on household mechanics; Polk on printing; Tustison on electricity; and Brown and Tustison on woodworking. The following have published materials using the *operation-sheet* approach: Brown and Tustison on woodworking, Hoelscher and Mays on drawing, Kelsey and Selvidge and Smith and Kern on auto mechanics, McGee and Brown on wood finishing, Selvidge and Christy on sheet metal, and Willoughby on electric work.

3. *Adaptability of different methods.* London states the problem here as follows: In which area and at what grade level is any method best adapted? Certain criteria are cited for treating the question: (*a*) outcomes judged by noting pupil achievement in knowledges, habits and skills, attitudes and appreciations; (*b*) economy of work; (*c*) organization problems, including the ease of handling large classes.

A number of experimental studies on method should be reviewed. Adams (1) and Borofka (13) studied short-unit performance tests as teaching devices in drawing and in foundry, respectively; Dickman (24) experimented with self-directed vs. teacher-directed study in learning to assemble mechanical apparatus; Digby (25) compared the orthographic and isometric approaches in drawing; Douglass at Iowa State and Anderson (3) at Rutgers compared oral and written instruction in junior-high-school woodworking regarding mastery of informational content; Gunderson (34) at Wisconsin investigated the effectiveness of the demonstration in developing problem solving and planning ability in junior-high-school woodwork; Gunther (35) at Columbia and Paine (60) at Yale have experimented in methods of teaching elementary industrial arts; and London (49) compared the groups using the job sheet and the operation sheet, respectively, with equivalent control groups on the basis of eight phases of pupil achievement and from the standpoint of economy of instruction and ease of handling.

4. *Certain conclusions.* London reports some interesting conclusions concerning the methods he has studied, as follows:

a) Individual instruction sheets are superior to the traditional demonstration oral-instruction methods as regards the mastery of information.

b) *Assuming* that "good" instruction sheets are prepared and that teachers know how to use them, there is evidence that such a method does enable the teacher to handle large classes just as effectively, insofar as specific instructions are concerned, as with the traditional method.

c) Little, if any, difference is found in the ease with which skill is developed under the three methods used.

d) Seventh-grade boys prefer the job-sheet method and can do more woodwork in a given time by its use. The joker here, of course, is "teacher interest," *which will vary any conclusion.*

e) The traditional method is a bit more expensive in point of consumable materials wasted.

f) Perspective-type drawings are more effective in giving pupils information from drawings and in helping them to visualize objects in three dimensions than are orthographic drawings.

g) Beginning pupils in woodwork produce a slightly better product under the traditional method than under either the job-sheet or operation-sheet method, but they require more demonstration and likewise more time. This is probably quite natural.

h) Manipulative participation by children in elementary-school classes, according to Gunther (35), adds materially to the learning and retention of facts as contrasted to studying these facts directly from books.

i) Planning and problem-solving abilities can and should be developed in the school shop. The demonstration is moderately effective for this purpose. Pupil participation in the analysis and planning of their projects is quite effective, although objective tests reveal that one semester's experience results in only a small gain over groups not having this experience.

j) Assuming both valid methods and content, pupils learn more about reading drawings through working with them in a shop than they do through making them in the drawing room. The *planning room* idea in connection with all laboratory developments is therefore quite sound. Seventh-grade boys who have worked from drawings make a better score on objective tests in the reading of drawings than do ninth-grade boys who have worked from templates and not from drawings.

All of the writers reported above will agree that the scope of the topic of *method* in teaching is even broader still than they have revealed and that much research remains to be done. Our development of the pupil-personnel or shop-organization idea (89) as far back as 1922 still provides a big topic for study. Many others could be listed. No doubt hundreds of specific methods could be drawn from larger or more general classifications.

Researches concerning devices have not even been mentioned. *Curriculum tools* or *devices* include many *material items* which have varying degrees of usefulness in successful shop teaching. The uses of films and books in teaching are but examples of a broad field for study.

Tests and Scales. The objective-test movement in education has been one of the most remarkable developments of recent years according to Burl N. Osburn in his foreword to the *Symposium on Testing* (27):

> Shop teachers, for the most part, have accepted it uncritically, have bought or devised tests, and have given them with little thought or result beyond the questionable satisfaction of believing themselves up-to-date.
>
> Many teachers have neither learned how to devise an informal objective test nor learned how to select and use a standardized test form intelligently. The commercial development, therefore, has not only gained by this situation, but has done much to stimulate the widespread acceptance and use of the testing device. It may be safely said that not all published tests are good tests, that not all good tests are valid or reliable in the hands of many purchasers, and that not all good tests when properly given contribute effectively to an improvement of teaching.

The Epsilon Pi Tau *Review* for 1931 presents the most exhaustive treatment of industrial-arts testing now available. It presents both what has been accomplished and what some of the opportunities or needs are for the future. The names of the authors are shown in connection with the table of contents, which reads as follows:

A Professional View of Testing (William E. Warner)
Historical Development of Tests (Ralph W. Sharp)
Purposes of Testing (Verne C. Fryklund)
Classes of Tests (DeWitt Hunt)
Types of Test Elements (Elroy W. Bollinger)
Criteria for Evaluation (Elroy W. Bollinger)
Construction of Paper Tests (DeWitt Hunt)
Construction of Performance Tests (L. V. Newkirk)
Rating Scales (R. L. Schwanzle)
Giving and Scoring Tests (Burl N. Osburn)
Interpreting Results (Burl N. Osburn)
The Testing Program (Burl N. Osburn)
Glossary of Terms (Horace B. English)
Bibliographies of Tests and Testing (Homer J. Smith and DeWitt Hunt)

Study of the above symposium should lead the reader to a more critical appreciation of the whole subject of testing and will direct attention to many research needs in this poorly used and little understood side of industrial-arts education.

Organization. A whole range of research is opened by this topic. We have broken the problem down into some twenty major points for study. Since organization effects many phases of teaching, some of the points overlap but the field for study is large. The increasing complexity of content and the resulting complexity of the physical layout, along with problems presented by larger classes and the necessity for lowering unit costs, in addition to the need for carrying on a superior program — all point to the importance of problems in organization. The accomplishments of Ashley (5) on record forms, Caswell (17) on the determination of curriculum units, Decker (21) and Miller (53) on the development of testing programs, Metzger (52) on maintenance, Moore (55) on costs, Wikoff (91) on exhibits, and others have all developed an initial group of valuable documents concerning this phase of industrial-arts education.

Physical Planning. The nine groups of researches completed or under way in this very significant phase of industrial-arts study have only recently been summarized by the writer (87). The following topics and their authors are reported, with a bibliography:

Location
Size and Shape
Principal Units (Caswell, 17)
Auxiliary Facilities
Equipment Provisions
Building Details (Whitehead)
Service Features (Robert)
Lighting (Bollinger, 12; see also Luckiesh, 50)
Noise (Berglund and Fiedler, 10)

Nomenclature. The Western Arts Association's *Terminological Investigation* (88) has been discussed earlier in this report (see also 8). It suggests still other studies, particularly by way of clarification and dissemination. Perhaps the most

significant statement in the entire investigation is the declaration that: *If a term is to be satisfactory, its derivation must check with what it is supposed to describe,* and the description must be of something valid as determined by sound educational principles.

Teacher Studies. All too little attention has been focused by research workers on the teacher who carries on from day to day. Studies concerning method are naturally closely related, as are those of organization. But what of attitudes and influence? The closest parallel to what we have in mind as a problem for industrial-arts situations, is the Commonwealth research by Charters and Waples (19) in addition to similar studies by Bagley and Bonser (86, pp. 58, 59). Very little has been done, however, which relates specifically to the industrial-arts teacher.

Supervision. The central researches in this phase of work have been directed by Dr. Homer J. Smith at the University of Minnesota (72, 73). The thesis by John E. Fintz (30) possesses considerable merit because it is both practical and projective concerning problems in *centralized supervision.* Very little published material on industrial-arts supervision, however, is available.

The round table on City Supervision[3] sponsored by Epsilon Pi Tau in connection with meetings of the Western Arts Association in Detroit on March 23, 1934, drew out certain central topics (see also page 56 in the 1932 *Review*) which may be of interest. These topics are listed here simply as they were taken down, and are not interpreted or presented in any definite order.

Administration vs. supervision.
The supervisor's professional status.
Duties of the supervisor (need for survey of practice).
Public relationships.
Techniques of supervision.
What are best principles and practices?
Supervision from the viewpoint of administration.
Supervision from the viewpoint of the teacher.
Functional types of supervision defined.
Creative supervision.
The economy of supervision.
What should the supervisor be called?
What are his duties?
The supervisor and his profession.
Professional: teacher, principal, relationships.
Student-teacher supervision.
Criteria for evaluating supervision.
Personal qualifications of the supervisor.
Educational qualifications of the supervisor.

Members of this informal round table referred to certain helpful references. These were by Kyte (48); Wright and Allen (94); another was the recent Chicago Survey; and reference was also made to Cressman's list of 66 duties.

Teacher preparation. Two dissertations, one by Strickler (76) on *Training and Experience,* and another by the writer (86) on *Policies,* were completed in 1928 on problems concerning the teacher and his preparation. It is reasonable to suggest that periodic studies and check-ups should be made, particularly when one sees so many undeveloped programs in the United States.

Programs involving interesting and noteworthy departures should certainly be studied at: Corvallis, Oregon, for curriculum organization; Stillwater, Oklahoma, for production experiences; Menomonie, Wisconsin, for organization and counseling techniques; Chicago (Normal College) for in-service training and developments planned for the eight-grade elementary schools of Chicago; and Charleston, Illinois, for its unit and administrative developments; Columbus, Ohio, for its Laboratory of Industries vestibule course and graduate program; and Millersville, Pennsylvania. One of the most pressing current problems, which seems to be drawing considerable attention, concerns the *selection* of prospective teachers for training. Another problem is that of professionalizing the prospective industrial-arts teacher. Some schools are already taking a fifth year to accomplish this end. The point which must be recorded again, however, is that very little still is available of a scientific nature concerning this very significant problem.

Administration. One sometimes asks concerning the nature of administration. Here again Dr. Homer J. Smith (73) of the University of Minnesota has directed the principal researches. (See also 93.) Administration problems concern local, state regional, and national programs. Questions of policy (86), organization (5), operation, subsidation, certification, costs (55), and control (84) are suggestive of a far wider field for study. Various school types present different problems of administration. These include fraternal, orphan, crippled, cardiac, blind, deaf, insane, criminal, etc., in addition to public-school programs on all grade levels. The professional associations all provide an unworked opportunity for administrative research. All too few of them have checked back to see how better programs and services could be developed in the future. The N.E.A., the A.V.A., the W.A.A., and various state associations all will bear study, in addition to administrative questions concerning college, city, and local school programs.

This paper has attempted throughout to familiarize the reader with not only certain accomplishments and needs in industrial-arts research but with something of its prerequisites and nature. Restrictions of space and time have limited the examples and treatment largely to problems concerning the secondary school, where most of the studies are now to be found. This is to be regretted, of course, but broader treatments will follow as more work is done. It is sincerely hoped that the industrial-arts teacher will become more deeply interested in the problems of his field than formerly. Many splendid advances are possible if individuals and organized groups will do what they can to develop this unusually valuable instrument of professional progress.

Selected Bibliography

1. Adams, Henry P. *A Study to Determine the Effectiveness of Performance Tests: Their Application to Ninth-Grade Drawing When Given over Short Units of Related Work.*

2. Allen, Charles R. *The Instructor, the Man, and the Job.* Philadelphia, Lippincott, 1919, 373 pages.

3. Anderson, Algot B. *Effectiveness of Written Individual Instructions as Compared with Oral Group Instructions in Woodworking.* M. A. Thesis, Rutgers University, New Brunswick, N. J., 1931, 42 pages.

4. Anderson, Lewis F. *History of Manual and Industrial School Education.* N. Y., D. Appleton, 1926, 251 pages.

5. Ashley, Lawrence F. *Administrative Problems in Industrial Arts Organization with Special Reference to the Use of Shop Forms in the Secondary School.* M.A. Thesis, Ohio State University, Columbus, 1932, 260 pages.

6. Bennett, Charles A. *History of Manual and Industrial Education up to 1870.* Peoria, Ill., The Manual Arts Press, 1926, 461 pages.

7. Bennett, Charles A. *The Manual Arts.* Peoria, Ill., The Manual Arts Press, 1917, 116 pages.

8. Bennett, Charles A. *Historical References to the Terms We Use.* Western Arts Association *Proceedings,* 1934.

9. Bennett, Charles A., and Others. *Historical Research in Industrial Education.* Ames, Iowa, State College, Industrial Arts Department Publications, 1933, 72 pages. See also pp. 108–115 in the Western Arts Association *Proceedings,* 1933.

10. Berglund, Erick B., and Fiedler, William R. *School Shop Noises: An Investigation of Their Nature, Effects, and Reduction.* M.A. Thesis, Ohio State University, Columbus, 1933, 116 pages.

11. Bollinger, Elroy W. *A Study of Professional Terms Used in Industrial Arts and Vocational Education.* M.A. Thesis, Ohio State University, Columbus, 1931, 141 pages.

12. Bollinger, Elroy W. "Securing the Right Kind of Light."

[3]The following city supervisors attended this meeting, chairmanned by Dr. George E. Myers of the University of Michigan: Burton A. Adams, Springfield, Mass.; Charles F. Bauder, Philadelphia, Pa.; Earl L. Bedell, Detroit, Mich.; Elmer W. Christy, Cincinnati, Ohio; Carl T. Cotter, Toledo, Ohio; Paul T. Cressman (state supervisor), Lansing, Mich.; George C. Donson, Washington, Pa.; John E. Fintz, Cleveland, Ohio; G. H. Hargitt, St. Louis, Mo.; F. R. Kepler (drawing), Detroit, Mich.; Frank C. Moore, Cleveland, Ohio; Lowell B. Selvy, Norwood, Ohio; A. C. Tagg, Dearborn, Mich; Harold J. Van Westrienen, Hamtramck, Mich.; William H. Vogel (art), Cincinnati, Ohio; and Harry E. Wood, Indianapolis, Ind.

Industrial Arts and Vocational Education, Milwaukee, The Bruce Publishing Co., March, 1933, pages 135–141.

13. Borofka, Philip J. *An Experiment with Written Instructional Materials in Industrial Arts Teaching, Using Two Equivalent Groups in the Foundry Unit.* M.A. Thesis, Ohio State University, Columbus, 1931, 267 pages.

14. Bower, May E. *The Contributions of Booker T. Washington to Education.* M.A. Thesis, University of Southern California, Los Angeles, 1922, 107 pages.

15. Bruner, Herbert B. *A Tentative List of Approaches to Curriculum and Course of Study Construction with Suggested Bibliographies,* Mimeographed. N.Y., Teachers College, Columbia University, 1934, 11 pages. See other references by this author.

16. Carter, Thomas P. *The Invention of Printing in China and Its Spread Westward.* N.Y., Columbia University Press, 1925, 282 pages.

17. Caswell, William E. *Selecting the Units for the Secondary-School Industrial Arts Program.* M.A. Thesis, Ohio State University, Columbus, 1932, 58 pages.

18. *Cellini, Benvenuto, The Autobiography of.* Tr. by J. A. Symonds. N.Y., Garden City Publishing Co., 1927, 403 pages.

19. Charters, W. W., and Waples, Douglas. *The Commonwealth Teacher Training Study.* Chicago, University Press, 1929, 666 pages.

20. Cooley, Edwin G. *Vocational Education in Europe* (2 vols.). Chicago, The Commercial Club of, 1912, 347 pages and 177 pages.

21. Decker, George C. *A Testing Program in Junior-Senior High School Industrial Arts Classes as an Aid to Guidance.* M.A. Thesis, Ohio State University, Columbus, 1933, 81 pages.

22. DeVette, William A. *Educational Aspects of the Dutch Craft Guilds.* M.S. Thesis, University of Pittsburgh, 1931.

23. Dewey, John. *Democracy and Education.* N.Y., Macmillan, 1916, 434 pages. See Chapters 1, 2, 4, 9, 10, 11, 13, 14, 20, 23.

24. Dickman, Hilmer C. *An Experiment in Two Methods of Industrial Arts Teaching.* M.A. Thesis, Ohio State University, Columbus, 1932, 52 pages.

25. Digby, Edwin E. *A Comparative Study of Two Methods of Teaching Drawing.* M.A. Thesis, Ohio State University, Columbus, 1933, 116 pages.

26. Douglas, Paul H. *American Apprenticeship and Industrial Education.* N.Y., Columbia University Press, 1921, 348 pages.

27. Epsilon Pi Tau, The *Review.* Symposium on *Testing* in Industrial Arts and Vocational-Industrial Education. 64 West Woodruff Ave., Columbus, Ohio, 1931.

28. Epsilon Pi Tau, The *Review.* Symposium on *Public and Professional Relationships* in Industrial Arts and Vocational-Industrial Education. 64 West Woodruff Ave., Columbus, Ohio, 1934.

29. Epsilon Pi Tau, The *Review.* Symposium on *Research.* In preparation. 64 West Woodruff Ave., Columbus, Ohio, 1935.

30. Fintz, John E. *The Problem of Centralized Supervision in Industrial Arts, with Special Reference to the Preparation of Instructional Materials.* M.A. Thesis, Ohio State University, Columbus, 1933, 109 pages.

31. Friese, John F. "Some Principles or Accepted Interpretations of Industrial Arts." Mimeographed. State College, Pa., 1933, 11 pages. See also the Mississippi Valley Conference Anniversary Volume.

32. Friese, John F. *Course Making in Industrial Education.* State College, Pa., published by the author, 1934, 175 pages.

33. Glover, John G., and Cornell, William B. *The Development of American Industries.* N. Y., Prentice Hall, Inc., 1932, 932 pages.

34. Gunderson, Howard B. *Experimental Determination of the Effectiveness of Demonstrations in Woodworking in Terms of Problem Solving.* M.A. Thesis, University of Wisconsin, 1931, 51 pages.

35. Gunther, Theresa C. *Manipulative Participation in the Study of Elementary Industrial Arts.* N. Y., Bureau of Publications, Teachers College, Columbia University, 1931, 58 pages.

36. Hale, William P. *Mechanical Drawing Content Based on Consumer Needs.* M.S. Thesis, Iowa State College, Ames, 1932, 65 pages.

37. Hankammer, Otto A. *Content of High School Drawing.* M.A. Thesis, Ohio State University, Columbus, 1929, 102 pages.

38. Harms, Louis A. *The History of Education Through Apprenticeship in the American Colonies, 1620–1776.* M.A. Thesis, University of Chicago, 1914, 119 pages.

39. Harper, Robert F. *The Code of Hammurabi, King of Babylon About 2250* B.C. Chicago, University of Chicago Press, 1903, 192 pages, 103 plates.

40. Hauenstein, E. A. "Drawing: Public School Applications." Western Arts Association *Proceedings,* 1933, pages 153–161.

41. Hoelscher, Randolph P. *The Teaching of Mechanical Drawing.* N. Y., John Wiley & Sons, Inc., 1929, 229 pages.

42. Hunt, DeWitt. *A Study of the Term "Consumers' Knowledges" and Its Use as an Industrial Arts Objective.* M.A. Thesis, Ohio State University, 1931, 148 pages.

43. Hunter, Dard. *Paper Making Through Eighteen Centuries.* N. Y., W. E. Rudge, 1930. 358 pages.

44. Hunter, William L., and Others. *Annotated List of 800 Graduate Theses and Dissertations in Industrial Arts Education and Vocational Industrial Education Accepted by Institutions of Higher Learning in the United States from 1892 to 1933.* Iowa State College, Ames, 1933, 89 pages.

45. Hutchinson, Herbert H. *An Etymological Study of Certain Professional and Scientific Terms in the Vocabulary of Industrial Arts and Vocational Industrial Education.* M.A. Thesis, Ohio State University, Columbus, 1930, 106 pages.

46. Kent, Ernest B. *The Constructive Interests of Children.* N.Y. Bureau of Publications, Teachers College, Columbia University, 1907, 78 pages.

47. Kramer, Stella. *The English Craft Guilds: Studies in Their Progress and Decline.* N. Y., Columbia University Press, 1927, 228 pages.

48. Kyte, George C. *How to Supervise.* Boston, Houghton-Mifflin Co., 1930, 468 pages. See other references by this author.

49. London, Hoyt H. *Individual Instruction Sheets in Industrial Arts Teaching: An Experimental Comparison of the Job-Sheet and Operation Sheet Methods.* Ph.D. Dissertation, Ohio State University, Columbus, 1934, 235 pages.

50. Luckiesh, M. *Lighting Data Bulletins* and other significant publications, including *Light and Work, Lighting and Seeing.* Nela Park Laboratories, Cleveland.

51. McGee, Richard A. *Interests, Capacities, and Socio-Economic Status of University of Minnesota High School Boys.* M.A. Thesis, University of Minnesota, Minneapolis, 1928, 120 pages.

52. Metzger, Clarence J. *Maintenance Problems in Industrial Arts Laboratories.* M.A. Thesis in process, Ohio State University, Columbus, 1934.

53. Miller, Clarence D. *Tentative Vocational Choices and Subsequent Careers of 183 Secondary School Boys.* M.A. Thesis, Ohio State University, Columbus, 1932, 233 pages.

54. Mississippi Valley Conference, Anniversary Volume. *Industrial Arts in Modern Education.* Edited by Charles A. Bennett, Peoria, Ill., 1934.

55. Moore, Frank C. "Accounting for Ourselves." The Epsilon Pi Tau *Review,* 1933, pages 19–21.

56. Neuburger, Albert. *The Technical Arts and Sciences of the Ancients.* Tr. by H. L. Brose. London, Methuen & Co., Ltd., 1929, 518 pages, 676 illustrations.

57. Newkirk, Louis V. *Validating and Testing Home Mechanics Content.* Ph.D. Dissertation, University of Iowa, Iowa City, 1929, 141 pages. See other references by this author.

58. Osburn, Burl N. *Constructive Avocational Interests of Secondary School Boys.* M.A. Thesis, Ohio State University, Columbus, 1931, 92 pages.

59. Osburn, Burl N. "Objectives Validation." Western Arts Association *Proceedings,* 1933, pages 95–101.

60. Paine, Olive. *An Experimental Study of Two Methods of Teaching Industrial Arts in the First Grade.* Ph.D. Dissertation, Yale University, New Haven, Conn., 1930.

61. Paterson, Donald G., and Others. *Minnesota Mechanical Ability Tests.* Minneapolis, University of Minnesota Press, 1930, 586 pages.

62. Patlow, John R. *The Selection of Adjustment and Service Jobs for a Car-Owner Repair Course in Auto Mechanics.* M.A. Thesis. University of Nebraska, Lincoln, 1930, 74 pages.

63. Phipps, Raymond W. *Frederick G. Bonser: A Biographical Study of His Early Life.* M.A. Thesis in process, Ohio State University, Columbus, 1935.

64. *Recent Social Trends in the United States* (2 vols.). New York, McGraw-Hill Book Co., 1933. 1568 pages. In addition to foreword, see Chapter VI, Shifting Occupational Patterns; XVII, The People as Consumers; XVIII, Recreation and Leisure-Time Activities; XIX, The Arts in Social Life.

65. Richards, Charles R. *Industrial Museums.* N. Y., Macmillan Co., 1925, 117 pages. See other references by this author.

66. Royer, Nena S. *A Study of Vocational Education in the Old Spanish Missions.* M.A. Thesis, University of Southern California, Los Angeles, 1926, 53 pages.

67. Sadler, Sir Michael E. *Continuation Schools in England and Elsewhere.* Manchester, Manchester University Press, 1908, 779 pages.

68. Salomon, Otto. *The Theory of Educational Sloyd.* London, George Philip & Son, 1892, 150 pages.

69. Sanders, Herbert H. *Decorative Processes in Pottery.* M.A. Thesis, Ohio State University, Columbus, 1933, 94 pages, 41 plates. See also the Williams' thesis on *Pottery.*

70. Seybolt, Robert F. *Apprenticeship and Apprentice Education in Colonial New England and New York.* N. Y., Bureau of Publications, Teachers College, Columbia University, 1917, 121 pages.

71. Siepert, Albert F. *Methods in Industrial Arts: A Survey of* Progress. (Approximate title.) See Mississippi Valley Conference Anniversary Volume, 1934.

72. Smith, Homer J. *The Administration and Supervision of Vocational Education in Cities, with Particular Reference to Industrial Education.* Ph.D. Dissertation, University of Minnesota, Minneapolis, 1926, 245 pages.

73. Smith, Homer J. *Administration and Supervision in Industrial Arts.* See Mississippi Valley Conference Anniversary Volume, 1934.

74. Smith, Homer J. *One Thousand Problems in Industrial Education.* Minneapolis, University of Minnesota Press, 1931.

75. Stenquist, John L. *Measurements of Mechanical Ability.* N. Y., Bureau of Publications, Teachers College, Columbia University, 1923, 101 pages. See other references by this author.

76. Strickler, Fred. *The Training and Experience of 480 Industrial Arts Teachers.* N. Y., Bureau of Publications, Teachers College, Columbia University, 1927, 115 pages.

77. Strong, Edward K. *Change of Interests with Age.* Stanford University, California, University Press, 1931, 235 pages.

78. Strube, Paul E. *Content for High School Farm Shops, Based Upon a Survey of What Master Farmers and County Agents Consider Important.* M.A. Thesis, Ohio State University, 1932, 84 pages.

79. Thorndike, Edward L., and Others. *Prediction of Vocational Success.* N. Y., The Commonwealth Fund, 1934, 285 pages.

80. Toops, Herbert A. *Tests for Vocational Guidance of Children Thirteen to Sixteen.* N. Y., Bureau of Publications, Teachers College, Columbia University, 1923, 159 pages.

81. Turner, Jennie McMullin. *Apprentice Education.* Federal Board for Vocational Education Bulletin 87. Washington, Government Printing Office, 1923, 521 pages.

82. United States Office of Education. *Industrial Education Leaflets.* Government Printing Office, Washington, D. C. Inquire for a list of the series now available.

83. Waldeck, Philip S. *Content of Junior High School General Metal Work.* M.A. Thesis, Ohio State University, Columbus, 1932, 94 pages.

84. Warner, William E. *The Control of the Continuation School.* M.S. Thesis, University of Wisconsin, Madison, 1924, 136 pages.

85. Warner, William E. "Industrial Arts Problems Needing Study." *Education,* June, 1932, pages 600–605.

86. Warner, William E. *Policies in Industrial Arts Education.* Columbus, Ohio State University Press, 1928, 90 pages.

87. Warner, William E. "Studies in School-Shop Planning." Industrial Arts and Vocational Education, Feb., 1934, pages 31–38.

88. Warner, William E., Bollinger, Elroy W., Hutchinson, Herbert H., and Others. *The Terminological Investigation.* Western Arts Association *Bulletin,* 17:2, 1933, 44 pages.

89. Warner, William E., and Others. *Organized Pupil Personnel in the Laboratory of Industries.* Columbus, Ohio, State University, 1930, 53 pages. (Mimeographed and bound.)

90. Warner, William E., and Pugh, Gerald G. *Annotated Bibliography of Fifty-Five References in English on Period Style Furniture.* Mimeographed. Columbus, Ohio State University, 1928, 11 pages.

91. Wikoff, Charles H. *Developing and Judging the School Shop Exhibit.* M.A. Thesis, Ohio State University, Columbus. 1930.

92. Woodward, Calvin M. *The Manual Training School.* Boston, D. C. Heath & Co., 1887, 366 pages.

93. Wright, J. C., and Allen, Charles R. *Administration of Vocational Education of Less than College Grade.* N. Y., John Wiley & Sons, 1926, 436 pages.

94. Wright, J. C., and Allen, Charles R. *The Supervision of Vocational Education of Less than College Grade.* N. Y., John Wiley & Sons, 1926, 415 pages.

High-School Mechanical Drawing

R. P. Hoelscher

University of Illinois,
Urbana, Illinois

This article is from an address delivered before the drawing division of the Illinois Vocational Association in Chicago, November 4, 1933. While many readers may not agree with every suggestion contained in the article, nevertheless the thoughtful teacher of drawing will find much that may be extremely helpful.

THE successful defense or justification of the place of any subject in the high-school curriculum depends, first, upon our philosophy of education, and second, upon how widely and tenaciously that philosophy is held. It may be no broader than the view which takes note of the fact that schools are supported by taxes and that taxes may be reduced by cutting school expenses. Or, the philosophy may be based upon a broad social outlook which takes cognizance of the fact that the future of society depends upon the training of our youth, not only in our schools, but in all of their life experiences. Of these experiences the school may be the factor of greatest importance or it may fail entirely. Whether it succeeds or fails depends upon what it offers that seems of value now and not in the too distant future.

For the future welfare of the individual and the country our educational system should provide each child with the opportunity to achieve the maximum development which his ability and effort will permit. That development has a threefold aspect which must be attained in substantial measure if civilization is to endure. The three phases of development were given by Parker in his "Methods of Teaching in High Schools" as:

1. Social efficiency: (*a*) economic,
   (*b*) domestic, (*c*) civic.
2. Good will.
3. Harmless employment of leisure time.

Most of our educational philosophers have accepted these as the ultimate aims of education, although they all have expressed themselves in different words. They seem to meet the needs of society today as well as a decade ago so they may be accepted as they stand. The emphasis which is placed upon each of them, however, must vary with the total social situation; that is, with the capacity of the individual and the situation in which he finds himself. With the less able, the ability to care for themselves and to find wholesome enjoyment is paramount, while with the more able the development of good will and a sense of social responsibility is more important so that they may not become lawful leeches upon the body politic, sucking away its economic vitality for their own aggrandizement.

Before attempting to see if, and how, mechanical drawing serves a useful purpose in advancing the aims we have just set forth, let us look for a moment at the social situation about us. For many years past our social system, in school and out, has been tending toward a narrow specialization of the individual. The principle of "division of labor" invoked to increase the efficiency of the shop has led to the develop-

ment of skills in very narrow and restricted fields. The workman is a punch-press operator or he feeds this, that, or the other automatic machine. When the plant shuts down he is not qualified to do much else and is economically helpless.

In school the same process has been making itself evident, especially in the vocational-education field as is illustrated from the following quotation from an article in an educational magazine.

"In a properly organized city school program, the background of vocational education is not that of some distant corner of the United States or some remote nook in a foreign country. An efficient vocational program inducts its students into the community in which they live. The outstanding vocational training in Grand Rapids, Michigan, for example, centers around furniture making. In New England it is a question of textiles."

With this viewpoint, there is serious objection unless it can be guaranteed first, that the child born and educated in Grand Rapids will always stay there; second, that the furniture factories will always stay there, and third, that they will always stay in operation.

This tendency in social life is detrimental to the individual. In the shop the process is inevitable, but in the school it is not justifiable. In a textile-mill center, industrial-arts and vocational courses dealing with textiles must, no doubt, be offered, but for the ultimate welfare of the individual his attention should be directed along other lines. Then when the textile mills close their doors and move away where they can find cheaper labor, the workman will at least have an idea of other things he may do and other places to which he may go. Versatility is more important to the workman today than it ever has been in the past.

Education, yes, even vocational education, should broaden the mental horizon of the individual. A trade school may teach a trade and nothing else, but vocational education must do something more or it is misnamed.

With this as the basic philosophy of our educational program, let us see how mechanical drawing fits into this program.

How It Aids in Achieving the Ultimate Aims of Education

Economic aim. Mechanical drawing aids directly in the achievement of the economic aim of social efficiency since it provides in itself without other aid a direct means of employment. If taught from the viewpoint outlined in the foregoing it provides not merely entrance into a limited field of drafting but to the entire range which is quite wide. This means that in Gary, Indiana, or Bethlehem, Pennsylvania, the school will not specialize in structural drafting but will effectively lay the foundation for any kind of drawing. In Hawthorne it will not be electrical drafting but the fundamentals of drawing first, after which either the school or shop can add the details of electrical drafting.

Besides furnishing an entrance into a wide range of employment directly, mechanical drawing improves the chances for success and promotion in any kind of shopwork or building activity where drawings are used. It would make quite a formidable list if one should tabulate all the trades and occupations falling under this heading.

Domestic Efficiency. Domestic efficiency is enhanced by a knowledge of drawing. Machines of one kind or another are in use in every household. To buy intelligently and to use economically one should know something about the construction of the machines. Such information can best be obtained from drawings. While pictorial drawings are most widely used in advertising, even these require some knowledge of drawing to interpret correctly.

Every householder, especially if he owns his own house, at times wishes to make little changes and additions to his house and its permanent equipment. If he wishes to add metal weather stripping. for example, he can get illustrations of different brands, their costs and methods of installation, and then study them without a salesman to influence his judgment. Numerous other illustrations of the usefulness of drawing to every citizen, be he butcher or baker or preacher, can easily be added.

Good Will. Drawing as such adds nothing to the development of good will, but the drawing teacher may do as much in this respect as any other teacher by his general conduct and treatment of the pupil. The old saying that "Like begets like" is true here. A spirit of good will and fair dealing on the part of the instructor will do its part in developing a similar spirit in the pupil.

Enjoyment. The aim of developing habits of wholesome enjoyment will be discussed later.

The entire learning process may be divided into five types which can be identified although perhaps not entirely separated from each other by distinct lines of cleavage. These are given by Parker as:

1. Association of symbols and meanings.
2. Acquiring motor skill.
3. Acquiring skill in expression.
4. Acquiring habits of wholesome enjoyment.
5. Acquiring skill in reflective thinking.

Mechanical drawing furnishes an opportunity for practice in each one of these types of learning. If such is the case, then its position is as well justified as an instrument of education as any other subject.

Association of Symbols and Meanings. As usually discussed this refers primarily to foreign languages and the problem concerns itself with how these associations between the meaning and the symbol may be best established. Into this type of learning mechanical drawing fits perfectly, for it also is a language. Like the written language, it has its four major forms of expression analogous at least in number. In the place of narration, description, argumentation, and exposition, we have orthographic, isometric, oblique, and perspective as the four major forms of drawing. Every line we draw is a symbol and has a meaning, clean-cut and unmistakable to those who know the language. It also has the advantage of being a universal language which is used and understood by civilized men everywhere around the world. As we advance in the study we find that the vocabulary increases until there are literally hundreds of distinct symbols whose meaning the draftsman must know. In this regard, then, mechanical drawing must rate as high in an educational scheme as any language, foreign or native.

Motor Skill. The value of mechanical drawing as a means of training in motor skill is so obvious that we need not discuss it. The difficulty is that it is regarded by the laymen and all too frequently by administrative school officials as the only educational value which it has. This being an accepted value, it needs no further discussion.

Skill in Expression. Language, art, and music are recognized as means of expression. As a language, drawing opens up an entirely new and extensive field of experience. By means of mechanical drawing one can express ideas for which no other medium is at all adequate. Not only is it a means of expression in itself but it is the only medium which permits of the extensive expression of ideas in wood, steel, and stone.

Beauty in the static form of architecture to be seen on every hand in our large cities would not be there at all except for mechanical drawing. Beauty in the dynamic form of auto, train, steamship, and airplane would be impossible without this means of expressing ideas.

This refers not only to the mechanical and technical details of modern civilization but also to the external beauty of line and form which are expressed in terms of mechanical drawings.

Wholesome Enjoyment. Painting, music, playing games of skill are regarded as forms of wholesome enjoyment. A part of enjoyment in games of skill comes from the mere physical activity. A larger part, however, comes from the satisfaction of the mastery of a desirable skill, from the consciousness

of a thing well done. Such enjoyment and deep satisfaction mechanical drawing may provide. A very real part of the training in drawing not only may be, but should be the development of a spirit of pride in craftsmanship which will not be satisfied with anything less than the best.

A mechanical drawing may be a thing of beauty though not many people know it. It has within it the same possibilities for the expression of balance, symmetry, rhythm, uniformity, and contrast that any work of art may possess. The difference between a good drawing and a poor one lies just in the absence or presence of these qualities.

Mechanical drawing is also a means to an end in other forms of enjoyable activity. Model building, boat building, cabinetwork, and other constructive hobbies are all enhanced by a knowledge of drawing.

Reflective Thinking. In respect to the development of skill in reflective thinking or the reasoning process, drawing offers greater possibilities than many academic subjects. It contains all the possibilities for reasoning that geometry does, for it is nothing more or less than the practical application of the principles of descriptive geometry. Drawing problems may be set up which require the exercise of reason to follow through from given conditions to end results. In fact, most problems will involve some such difficulties unless the student has copied his work or "fudged" the answer. Neither process should be permitted in the drafting room.

These arguments seem to answer the question as to the place of mechanical drawing in the high-school curriculum. But one difficulty remains, and that is the fact that it costs more to teach one hundred students mechanical drawing than it does to teach the same number of students any of the so-called academic subjects. So long as this is true, pressure will be exerted, tending to eliminate the subject from the curriculum. Until recently also, drawing together with other shop subjects has suffered under the handicap of limited entrance credit value in our colleges and universities.

There is no definitely discernible tendency to remedy both of these conditions. The newly revised entrance requirements of one midwestern state university now permit the use of five free electives. Whereas, formerly only one entrance credit in drawing could be secured regardless of the amount earned in school, now the exact amount earned may be used if the school accepts the work for its own graduation, and the subject and school are accredited by the university.

Instead of the old double 40-minute period for one-half unit of credit, shorter time requirements may be substituted under certain limitations as to teacher preparation and the method of conducting the course. These new regulations make it possible to put drawing on a par with any laboratory science course so far as time requirements are concerned, thereby making it possible to reduce the teacher cost.

So far as operation is concerned, drawing costs no more, and perhaps somewhat less, than other laboratory subjects.

Does Mechanical Drawing Actually Produce Results?

It is one thing to set up the aims of a course and show how it meets the highest educational requirements, but it is quite another matter to achieve them. Objectives may be laid out in beautiful form and couched in the most convincing language, but if we will be honest with ourselves we will admit that paper objectives and actual achievement are far removed from each other.

Without indulging in the indoor sport of "passing the buck" to the high-school teacher, the writer would like to give a little insight into how the end-product of high schools, functions in college, particularly as applied to drawing. As will be made clear later, the criticism applies not to any teacher or to any school, but rather to a system that has grown up which can be improved.

For the past fifteen years the writer has been teaching engineering drawing to students who have had three or more years of drawing in high school. These young men come mostly from the large high schools of the large centers of population, so the following comments apply chiefly to schools of that type. For a period of years the writer also has been on a committee in connection with which he has visited many large high schools to inspect them for official purposes. This has afforded an excellent opportunity to observe both the process and the product of mechanical drawing in high schools.

What should be expected as the result of the training which these young men get in drawing may be determined from statements of aims and objectives which appear now and again in print in magazines. These must be taken with the traditional "grain of salt," for it seems quite certain that for the greater number of students many of these aims are not attained. The following is a list of just a few of the things which an impressive number of high-school graduates having had three or more years of drawing in our best high schools do not know or cannot do. At the time of the observation they were all freshman engineering students. It is left to the reader's judgment whether or not they should have been able to do them.

1. How to sharpen a drawing pencil and how to maintain it in proper condition for use.
2. How to find the center of an arc tangent to two intersecting straight lines.
3. Correct weight and character of the various types of lines in either pencil or ink.
4. How to draw a regular hexagon with the distance across corners given.
5. The meaning of such words as parallel and perpendicular.
6. How to make numerals and fractions for dimensioning.

There are only a few elementary things which a great number of students cannot do. The question naturally arises, if these simpler and more obvious aims have not been achieved, what about the more ephemeral objectives the attainment of which cannot be checked? The assumption would be that they are not attained.

What, then, is the difficulty? Is it the teacher? Sometimes, but usually not. Is it the method of procedure or does the trouble lie in other causes? I believe we can find at least a partial answer in further observations of actual conditions. We have observed a few facts about the product, so let us turn to the process.

The inspection of drawing classes has disclosed the following to be true.

1. Classes almost without exception crowded beyond limits where any reasonable hope could be held of achieving results. Between 35 and 40 students seems to be the standard.
2. Classes mixed as to grade; three and four grades in the room at the same time.
3. No textbook for study is used and no assignments made.
4. No regular recitations are held.
5. No written or oral work is done.
6. Completed solutions of problems are to be found tacked up in the room or otherwise available.

Under these conditions it is difficult to see how any of the aims upon which we have sought to justify mechanical drawing can be achieved for any appreciable number of students.

With 35 or more students in a class and from four to six classes a day, it is humanly impossible for an instructor to give the proper attention to the work of each student.

In answer to objections about mixed classes it is always stated that drawing is essentially a matter for individual instruction. The impression seems to be that this is the latest style in educational procedure. So far as drawing is concerned, individual instruction as now conducted under the conditions described above is purely a mental illusion.

Of course, individual instruction must be given. Every drawing ought to be checked over carefully with the student before he turns it in. But all the principles of drawing cannot be taught individually even with the best textbook available for private study.

To teach each student individually all the facts which he should know about any one learning unit of drawing is physically impossible. No man can and no human being will repeat 180 times a day all the facts which a student should have called to his attention. Most teachers, if discussing, let

us say, the use of half and full sections with a class, could take a full 40-minute period to do so. Even in this time probably a few of the finer points would be missed. Then, even if the students had privately studied a good text before the discussion, when they went to work on their drawings there still would be found plenty of misconceptions to straighten out by individual teaching to keep any teacher very busy.

If the student is to learn to read and acquire information from printed matter (a method which will be almost his only source of learning after he leaves school) he should have the opportunity to use a textbook not merely as a source of problems but also as a means of studying the facts and principles of drawing. This will relieve the teacher of the necessity of making long explanations to each individual and give him a chance to do some real individual teaching.

If drawing is to serve its full purpose the student must be given an opportunity to express himself in English, written and oral, as well as in drawings. In drawings he is being introduced to a new vocabulary of technical terms and he should have the chance and encouragement to use those terms correctly.

The recitation will not only permit the instructor to get across much information to the class but also give them a chance to express themselves in English.

To achieve in a more substantial measure the objectives by which we justify drawing, efforts should be made by all interested to bring about the following changes in the teaching of drawing.

1. That the maximum size of mechanical-drawing classes be 25 with a recommended optimum enrollment of 20.
2. That mixed classes be eliminated.
3. That regularly scheduled recitations be held (at least one a week) in a room other than the drawing room.
4. That a text containing material for study be used and that assignments be made in preparation for the recitation.
5. That regular written quizzes including the use of free-hand illustrations be given upon the theory and facts of the subject.
6. That the class be kept together as a unit for instruction with proper provision to care for the brilliant and extremely slow without advancing them beyond the class or allowing them to drop behind.
7. That speed be recognized as one of the objectives which is of value economically and also from the standpoint of education and culture.

A final suggestion would be a fuller appreciation of the possible educational value of mechanical drawing by the teachers of the subject. A teacher who realizes the possibilities and the challenge of just the fundamentals of drawing will not need to drag into the first two years extraneous materials to maintain interest. He will be able to keep his students busy both manually and mentally when he approaches the subject with the spirit of a master craftsman teaching his art.

THE GENERAL SHOP

General Shop for Rural Schools

R. L. Hamon H. E. Standish

George Peabody College for Teachers, Nashville, Tennessee

This article shows conclusively the place of industrial-arts work in the rural school as well as how to plan and arrange the shops for teaching this type of work.

THIS article deals with the question of the general shop for the rural school of eight grades, or with the small rural high school which cannot maintain unit shops or special teachers. There are thousands of these schools scattered throughout the states, especially the southern states, where the 8–4 plan is still the principal school organization.

The pupils of these schools should have the advantage of the industrial-arts program in order to make their educational experiences complete, because without this phase of education the school is failing to meet the needs of the student.

So far, little has been done to adjust or organize industrial work for the small rural school. There are a few cases where attempts have been made, but for the most part; it has been a unit of woodwork or of drawing and these have been taught in such a way that there is no correlation with other school subjects or with occupational information. Frequently poorly trained teachers, or teachers with no training at all, are attempting to teach some antiquated course to utterly disinterested and bored groups of pupils.

The industrial-arts program in the rural school should adapt itself to the community interests. Its aims should be:

"1. To teach the practical activities of a mechanical sort which confront men and women under normal living conditions, and to establish the relation of the basic sciences to these activities.

"2. To provide technical information and practical experience which will give pupils sounder judgment and keener power in the selection of the commodities commonly needed for normal living conditions.

"3. To afford the pupil an opportunity to explore his abilities and to test his aptitude for the common trades."[1]

Bobbitt[2] lists in his major objectives of education, also "unspecialized or nonvocational activities." Following is a partial list of the items which are of a high social utility and given as abilities to be acquired under this heading:

"Ability to use all common kinds of measuring devices.

"Ability to sharpen, adjust, clean, lubricate, replace worn or broken parts, and otherwise keep household and garden tools and appliances in good order and good working condition.

"Ability to make repairs, adjustments, and additions to the house and its equipment.

"Ability to make repairs, adjustments, and sometimes to construct household furniture and other equipment.

"Ability to participate intelligently in the original planning of one's home.

"Ability to operate household equipment.

"Ability to keep the house, premises, and equipment clean and sanitary.

"Ability to care for and operate the electrical system and appliances of one's home; and to make simple repairs, adjustments, or replacements.

"Ability to protect the home from fire."

This list of abilities contains much which might be embodied in a diversified course for the general shop. To these abilities might be added others pertaining directly to the experiences of normal life in any community. The farmer, for instance, must be able to maintain his equipment, and to make minor household repairs. These "handy-man" skills are a source of pleasure as well as of economic value because their possession may save him considerable money. The manipulative experiences should introduce the pupil to many phases of the world's industrial work and related information, and they should develop in him an appreciation for workman-

[1] *The General Shop*, by Newkirk and Stoddard (Peoria, Ill.: The Manual Arts Press), p. 35.

[2] *How to Make a Curriculum*, by Franklin Bobbitt (Boston, Mass.: Houghton Mifflin Company).

ship, materials, and commodities. They also should give him an attitude of pride and interest in the ability to do things for himself, and create confidence and self-reliance, and help him to develop hobbies for the worthy use of his leisure. Besides all this, through his industrial-arts experiences, the student should receive guidance in vocational preparation.

If the school neglects the practical activities of education, then it has failed to prepare the pupil for adult life. Most school subjects were brought into existence through practical need and have their only usage in practical affairs of life. Yet their separation from life activities has become so nearly complete that the child fails to see any relation in school experiences and out-of-school experience. It is because of this lack of connection that the school experiences have so little influence upon the behavior of individuals in after-school life.

"The general shop is a broad group of educative industrial-arts activities embracing techniques of shop organization and teaching method which enables a community, whether large or small, to present a unified case of content based on life needs. . . ."[3]

It is only through the industrial-arts program, which is representative of so many practical activities of home and community life, that the tool subjects are brought into close and vital connection with every-day situations in which the subject matter is usable. Only through this relationship can the tool subjects become a real benefit in the development of useful members of the home, community, state, and nation.

In the elementary school it is better that the grade teacher also teach industrial arts. If one teacher has charge of industrial arts, another arithmetic, another geography, there is danger either of much overlapping and duplication of work or of neglecting important relationships. If still another teacher has the English, the material about which the children really have something to speak and write can be of relatively little use as opportunity for the improvement of expression. On the other hand, if the related subjects are taught by one teacher, he can see just where each subject is needed and how to use its contributions at exactly the right time and place.

"The industrial-arts work makes so many demands upon arithmetic, geography, history, and English and likewise contributes so much in furnishing motives and problems subjects that the teaching of all of these by the same teacher in a given grade is essential for the most effective and economical work. The teaching of each is made more easy and effective by the use of the others. . . . Daily problems have their various aspects. They involve practical activity, the use of numbers, of geography, or history, or fine arts, of English, and of the co-operation of numerous people. It is possible and desirable to bring much of this unity of life into the school. By so doing, the schoolwork becomes more nearly genuine practice of life activities themselves. No other phase of school has such great possibilities for bringing about this unity of school and life experience as the comprehensive general-shop program."[4]

Friese says, "One of the chief aims of early junior high school [seventh and eighth grades in the 8–4 plan] manual arts is to have the boy make and do the things he likes to make and do."[5]

Every elementary- and junior-high-school teacher employed in the rural school should be able to teach one or more instructional divisions in the general shop just as efficiently as arithmetic, history, or English. The school superintendent should demand this of his rural teachers and they, in turn, will acquire these abilities at the teachers' colleges.

Planning the General Shop

Arrangement of the equipment in the general shop is a problem which should receive much serious thought. First, the type of course which is to be taught must be considered. The next step is to select equipment needed to teach this course, then arrange this equipment for the best and most efficient administration of the course of study. A careful organization of the shop means much to the teacher and to the accomplishment of the pupils. Shop arrangement has much to do with the elimination of disciplinary matters.

Space. The first consideration is the available space in which to arrange the needed equipment. Many times the room is already at hand and cannot be changed. The teacher, supervisor, or superintendent should make a careful study of the principal factors involved in setting up a convenient shop. In most cases in rural schools a building must be provided for the shop. These buildings may be of the portable type (some of which are very reasonable and substantial) or built of frame, brick, or tile, as the local conditions may warrant. The following important factors must be considered if the shop is to be efficient: (1) lighting — natural and artificial; (2) ventilation; (3) placing of equipment in relation of divisions; (4) location of tools and supplies; (5) accident prevention; (6) fire prevention; (7) teacher observation; (8) location of machinery; (9) working space; and (10) assembly space.

Lighting. In small shops it is most desirable to have all light coming from one side of the room, and its source should be to the left of as many working stations as possible. In the larger shops this would be impracticable, as windows must be placed on two or more sides. South light is very undesirable because of sun interference. Artificial light should be of the inclosed type to eliminate glare as much as possible and to give better distribution.

Ventilation. This has always been a problem in shop planning and must be handled individually to suit shop conditions. Fresh air should be circulated freely through the shop at all times. Special attention should be given to ventilating auto-mechanics and gas-engine classes. Ventilation is much easier to control when breeze windows are provided.

Equipment. Equipment should be so arranged as to facilitate the work of the pupil and to relieve congestion or needless passing from one section of the room to another. Tools and supplies should be located centrally so that they are easily accessible to the entire shop. In the small general shop, only one conveniently arranged tool supply case is needed.

Assembly Space. The small shop in the rural school should be planned either for assembly work in the regular classrooms or at the benches in the shop. There is little need of general assembly and it is not advisable to maintain separate space for this purpose.

Machinery. Very little machinery should be provided in the general shop for the rural school. The shop must lend itself to the needs of the community and hand-tool work must be stressed, as the rural boy will not have machinery at home and, therefore, if trained with machinery at the school shop he will fail to adapt his school activities to home conditions. However, in the larger shops it may be advisable to install a small saw table, a band saw, and a wood lathe. These are very convenient for the home shop if they can be provided.

Working Space. Machinery must be installed so as to provide free working space on all sides sufficient to handle with ease the material without interfering with other shop activities.

Ample space must be provided for the assembly of projects of various sizes without overcrowding or interfering with adjoining activities.

For the use of rural teachers and superintendents, eight layouts are being submitted which it is believed will suit the needs of the rural schools. Realizing the impossibility of standardizing the shop plans, these are submitted with the hope that they may be suggestive and that they may be of service to those who have to cope with the problem of supplying and administering an industrial program in the rural schools. It is hoped that this discussion may be the means of stimulating the thought of those who have to do with our rural schools, that more effort may be made to introduce the much needed industrial program which is suitable to community needs. The general shop is the only plan which can be justified in the small rural school as it lends itself to the varied interests and needs of the rural community better than the unit shop.

[3] *The General Shop*, by Newkirk and Stoddard (Peoria, Ill.: The Manual Arts Press), p. 11.

[4] *Industrial Arts for Elementary Schools*, by Bonser and Mossman (New York: The Macmillan Company), p. 74.

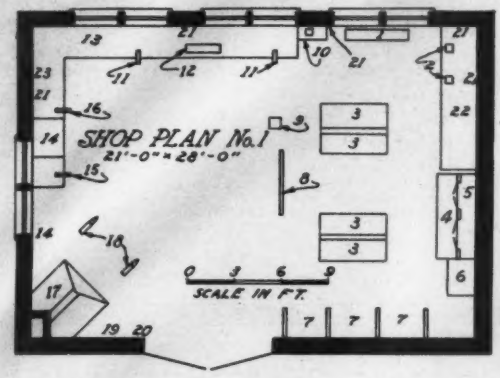
[5] *Exploring the Manual Arts*, by J. F. Friese (New York: The Century Company).

The introduction of shopwork in the rural eighth-grade school or small high school presents many problems. A special teacher cannot be provided for this work, which means that one or two of the regular teachers must handle the shopwork. Teachers must be selected who are capable of teaching this type of work as well as the regular grade work.

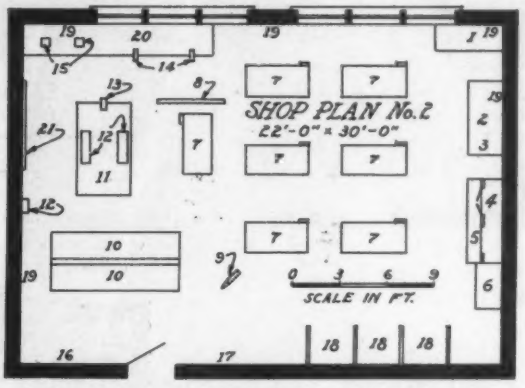
Newkirk and Stoddard[6] in their book, *The General Shop*, give a list of the advantages of the general shop:

"1. It is well adapted to the organization of industrial-arts content in the light of general education, exploration and guidance

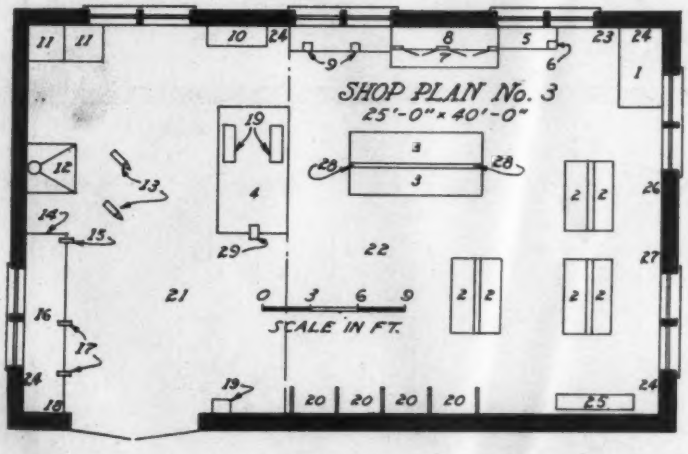
[6]*The General Shop*, by Newkirk and Stoddard (Peoria, Ill.: The Manual Arts Press), pp. 14, 15.



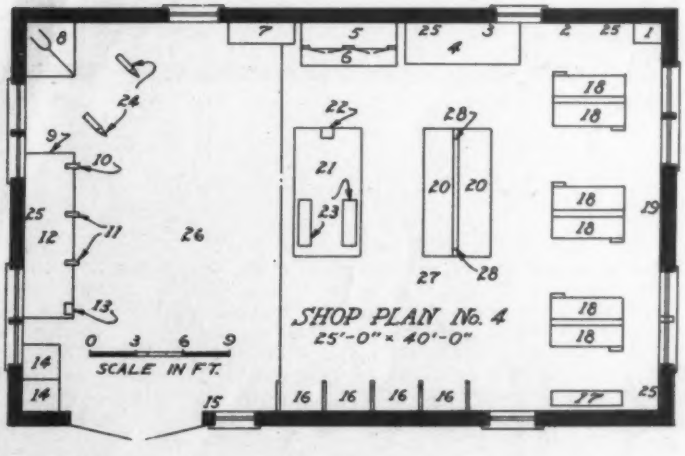
1. Wood Lathe
2. Solder Furnace
3. Woodwork Benches, Double
4. Tool and Supply Case
5. Bookcase
6. Sink
7. Lumber and Metal Rack
8. Blackboard
9. Pipe Vise-Chain
10. Sharpening Bench
11. Machine Vise, 4½"
12. Post Drill
13. General Bench
14. Sand and Cement
15. Blacksmith Vise, 4½ in.
16. Bench Drill
17. Single Forge
18. Anvil, 100 lbs.
19. Fire Extinguisher
20. Fire Extinguisher
21. Wall Plug
22. Electrical Bench
23. Bulletin Board



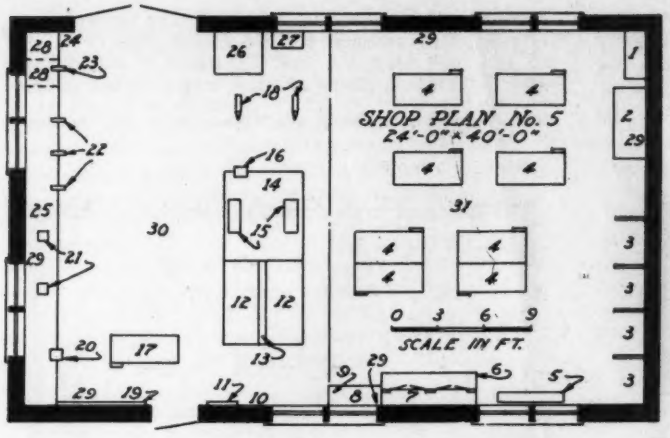
1. Sharpening Bench
2. Glue and Stain Bench
3. Tool Grinder
4. Bookcase
5. Tool and Supply Case
6. Sink
7. Woodwork Bench
8. Blackboard
9. Anvil, 100 lbs.
10. Electrical Bench
11. Metal Bench
12. Post Drill
13. Pipe Vise—Chain
14. Machine Vise, 4½"
15. Solder Furnace
16. Sand and Cement
17. Bulletin Board
18. Lumber and Metal Rack
19. Wall Plug
20. General Bench
21. Blackboard



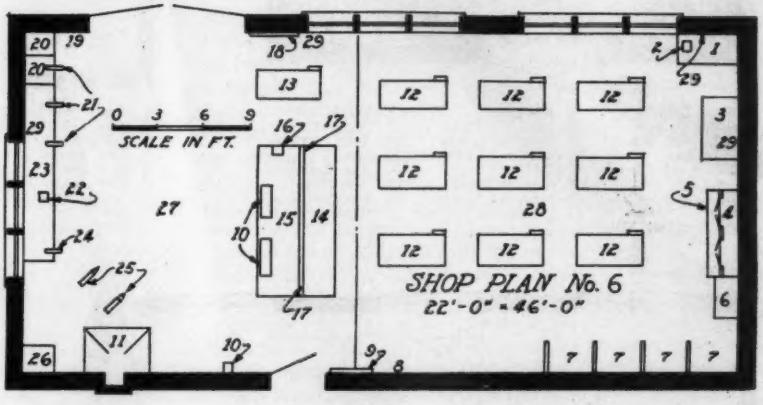
1. Glue and Stain Bench
2. Woodwork Bench, Double
3. Electrical Bench
4. Metal Bench
5. Sharpening Bench
6. Tool Grinder
7. Tool and Supply Case
8. Bookcase
9. Solder Furnace
10. Sink
11. Sand and Cement
12. Single Forge
13. Anvil, 100 lbs.
14. Blacksmith Coal
15. Blacksmith Vise, 4½"
16. General Bench
17. Machine Vise, 4½"
18. Fire Extinguisher
19. Post Drill
20. Lumber and Metal Rack
21. Cement Floor
22. Wood Floor
23. Fire Extinguisher
24. Wall Plug
25. Wood Lathe
26. Blackboard
27. Bulletin Board
28. Floor Plug
29. Pipe Vise—Chain



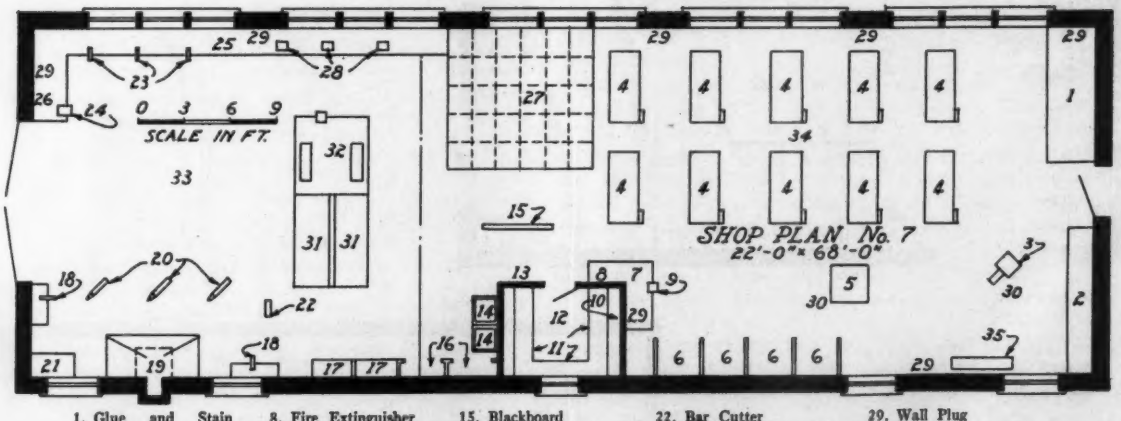
1. Tool Grinder
2. Bulletin Board
3. Fire Extinguisher
4. Glue and Stain Table
5. Bookcase
6. Tool and Supply Case
7. Sink
8. Single Forge
9. Blacksmith Coal
10. Blacksmith Vise, 4½"
11. Machine Vise, 4½"
12. General Bench
13. Bench Drill
14. Sand and Cement
15. Fire Extinguisher
16. Lumber and Metal Rack
17. Wood Lathe
18. Woodwork Bench, Double
19. Blackboard
20. Electrical Bench
21. Metal Bench
22. Pipe Vise — Chain
23. Post Drill
24. Anvil, 100 lbs.
25. Wall Plug
26. Cement Floor
27. Wood Floor
28. Floor Plug



1. Sink
2. Glue and Stain Bench
3. Lumber and Metal Rack
4. Woodwork Bench
5. Wood Lathe
6. Tool and Supply Case
7. Bookcase
8. Sharpening Bench
9. Tool Grinder
10. Fire Extinguisher
11. Bulletin Board
12. Electrical Bench
13. Floor Plug
14. Metal Bench
15. Post Drill
16. Pipe Vise — Chain
17. Demonstration Bench
18. Anvils, 100 lbs.
19. Blackboard
20. Bench Drill
21. Solder Furnace
22. Machine Vise, 4½"
23. Blacksmith Vise, 4½"
24. Fire Extinguisher
25. General Bench
26. Single Forge
27. Blacksmith Coal
28. Sand and Cement
29. Wall Plug
30. Cement Floor
31. Wood Floor



1. Sharpening Bench
2. Tool Grinder
3. Glue and Stain Bench
4. Bookcase
5. Tool and Supply Case
6. Sink
7. Lumber and Metal Rack
8. Fire Extinguisher
9. Bulletin Board
10. Post Drill
11. Single Forge
12. Woodwork Benches
13. Demonstration Bench
14. Electrical Bench
15. Metal Bench
16. Pipe Vise — Chain
17. Floor Plug
18. Blackboard
19. Fire Extinguisher
20. Sand and Cement
21. Machine Vise, 4½"
22. Solder Furnace
23. General Bench
24. Blacksmith Vise, 4½"
25. Anvil, 100 lbs.
26. Blacksmith Coal
27. Cement Floor
28. Wood Floor
29. Wall Plug



1. Glue and Stain Bench
2. Project Lockers
3. Band Saw
4. Woodwork Benches
5. Saw Table
6. Lumber Rack
7. Sharpening Bench
8. Fire Extinguisher
9. Tool Grinder
10. Bookcase
11. Paint Cabinet
12. Tool and Supply Room
13. Bulletin Board
14. Sink
15. Blackboard
16. Metal Rack
17. Sand and Cement
18. Blacksmith Vise, 4½"
19. Double Forge
20. Anvil, 100 lbs.
21. Blacksmith Coal
22. Bar Cutter
23. Machine Vise, 4½"
24. Bench Drill
25. General Bench
26. Fire Extinguisher
27. Recitation Space
28. Solder Furnace
29. Wall Plug
30. Floor Plug
31. Electrical Bench
32. Metal Bench
33. Cement Floor
34. Wood Floor
35. Wood Lathe

aims of the seventh, eighth, and ninth grades of the junior high school.

"2. It permits students to be treated as individuals with due respect for their differences and interests and to their capacity.

"3. It enables the student to discover his abilities and aptitudes through manipulation of a wide range of material and tool process.

"4. It offers an economical way to gain experience in many activities.

"5. It makes possible an adequate industrial program for the small school.

"6. It stimulates the setting up of a well-planned shop and a carefully organized teaching content.

"7. It increases teaching efficiency."

Industrial arts should begin with the first grade, but most of the activities of grades one to six can be conducted in the regular classroom with but little equipment. However, there

are phases of the fifth- and sixth-grade work which can be performed more satisfactorily in the shop.

The shop may also be used as a laboratory for beginning science or as a special-activity room for the lower grades.

Shop Layouts

Eight shop plans are submitted for rural schools. In some instances, there may be need for modifications to meet local conditions. The larger part of these shops are planned as separate buildings as this would be necessary with most rural schools. Several are planned 22 ft. wide and could be placed within the school building in case there were vacant rooms.

Mechanical drawing can be handled in three ways:

1. Use the regular classroom.
2. Use drawing boards on the shop benches.
3. Install manifold benches in shops.

Double benches may be used instead of single ones, thus increasing the pupil stations for the woodworking division by 20 per cent. However, there are disadvantages connected with the double bench: (1) they increase disciplinary problems; (2) cause interference with overhanging work; (3) produce interference through vibration.

The equipment in the plans may be identified by number which correspond with the numbers on the key list of equipment.

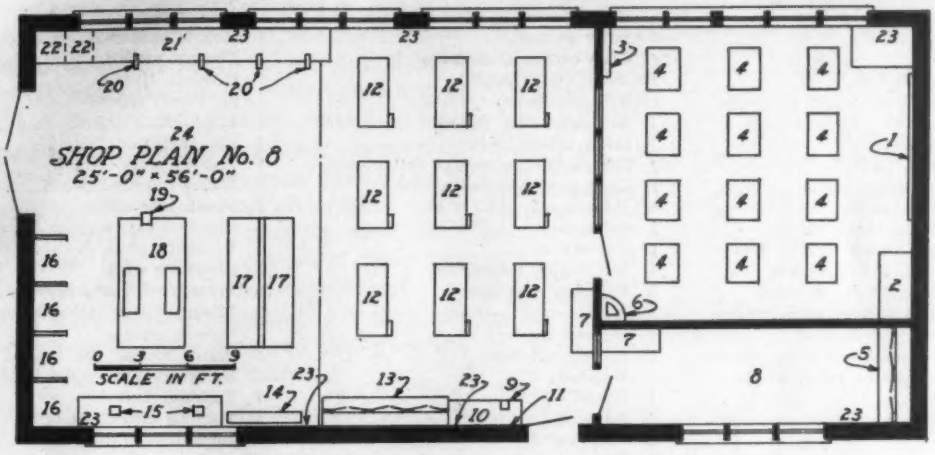
Plan 1. Room size, 21 by 28 ft. Pupil stations, 20. Instructional divisions: forge work, auto and gas engine, household mechanics (electricity, plumbing, furniture repairing, tool repairing, glazing), metal work (cold metal, sheet metal), woodwork, cement work, mechanical drawing.

Plan 2. Room size, 22 by 30 ft. Pupil stations, 25. Instructional divisions: woodwork, mechanical drawing, household mechanics (electricity, plumbing, furniture repairing, tool repairing, glazing), metal work (cold metal, sheet metal), cement work. The following activities may be added in Plans 1 and 2 without additional equipment: ropework, art fiber or reed weaving, art-metal work, construction work in grades four through six.

Plans 3 and 4. Room size, 25 by 40 ft. Pupil stations, 35. Instructional divisions, same as in Plan 1. Other activities, same as in Plan 1.

Plans 5 and 6. Room sizes: No. 5, 25 by 40 ft.; No. 6, 22 by 45 ft. Pupil stations, 35. Instructional divisions, same as in Plan 1. Other activities, same as in Plan 1.

Plan 7. Room size, 22 by 68 ft. Pupil stations, 40. Instructional divisions, same as in Plan 1. Other activities, same as in Plan 1.



1. Blackboard
2. Drawing Cabinet
3. Bookcase
4. Drawing Tables
5. Paint Cabinet
6. Washbowl
7. Sink
8. Finishing Room
9. Tool Grinder
10. Sharpening Bench
11. Bulletin Board
12. Woodwork Bench
13. Tool and Supply Case
14. Wood Lathe
15. Solder Furnace
16. Lumber and Metal Rack
18. Metal Bench
17. Electrical Bench
19. Pipe Vise — Chain
20. Machine Vise, 4½"
21. General Bench
22. Sand and Cement
23. Wall Plug
24. Cement Floor

Plan 8. Room size, 25 by 56 ft. Pupil stations, 35. Instructional divisions, same as in Plan 2. Other activities, same as in Plan 1. Plans 7 and 8 are for the larger consolidated schools where a special teacher is employed. Plan 8 provides for more specialized instruction in mechanical drawing and wood finishing.

Suggestive Tool Lists

These lists are based upon instructional divisions of the general shop as planned for the rural school. It will be necessary to make modifications of these lists to suit the varied requirements of localities and shop content. It would probably not be possible for two teachers, supervisors, or superintendents to agree in every detail of shop equipment. These suggested lists represent an attempt to select those tools which are quite adequate for the several divisions possible in the general shop and are believed to contain all that is necessary to conduct a general-shop course adapted to the needs of the rural pupil.

Forge Work (for 5 pupils)

1 Bolt clipper, ½-in.
3 Blacksmith hammers, 2-lb.
1 Sharpening hammer, 3-lb.
1 Ball-peen hammer, 1½-lb.
1 Blacksmith sledge, 6-lb.
1 Hot cutter
1 Cold cutter
1 Hardy for each anvil
2 Bolt tongs, 16-in.
3 Straight-lip tongs, 20-in.
1 each 3/16, ¼, ⅜, ½-in. hand punches
2 each ½, ¾-in. cold chisels
(Hand punches and chisels to be made in shop)
1 set of tap and dyes, ¼ to 1 in. (U.S.S.)
1 adjustable hack-saw frame
6 Hack-saw blades, 10-in.

Auto and Gas Engine (for 5 pupils)

1 set socket wrenches
1 set "S" wrenches
1 Monkey wrench, 8-in.
1 Monkey wrench, 10-in.
1 Valve-grinding tool
4 Pliers, 6-in.
4 Screw drivers, 8-in.
6 Assorted files

2 Ball-peen hammers, 1-lb.
2 Cold chisels, ½-in. (made in shop)
1 Lead mallet
1 Auto jack
1 Tube-repair kit

Woodwork (for 5 pupils)

Bench Set — for each individual bench

1 Jack plane, 14-in.
1 Backsaw, 12-in., 14-point
1 Marking gauge
1 2-fold 2-ft. rule
1 Socket firmer chisel, ½-in.
1 Socket firmer chisel, 1-in.
1 Sloyd knife, 3-in.
1 Bench duster
1 Saw board (made in shop)
1 Hickory mallet, 3- by 5-in.
1 Try-square, 6-in.

General Tools

2 Smooth planes, 8-in.
1 Block plane, 6-in.
1 Jointer, 24-in.
2 Framing squares
2 Bevel squares, 8-in.
1 Combination square, 12-in.
2 Screw drivers, 10-in.
1 Cabinet scraper (adjustable)
2 Hand scraper blades, 2½ by 4 in.
2 Crosscut saws, 24-in., 8-point
2 Crosscut saws, 24-in., 10-point
1 Nest of compass saws with handle
2 Ripsaws, 24-in., 7-point
1 Coping-saw frame and 6 doz. blades
2 Spokeshaves, 10-in., raised handle
1 Drawknife, 7-in.
1 Carborundum stone, 2-face, 1 by 2 by 8 in.
1 Gauge slip (medium)
3 Assorted nail sets
1 Level (aluminum) 24-in.
1 Bell-faced claw hammer, 10-oz.
1 Bell-faced claw hammer, 14-oz.
1 each ½-in. and 1-in. outside gouge
1 each ½-in. and ¾-in. inside gouge
1 Hand ax, 4-in. face
1 Cabinet file, 10-in.
1 Flat wood file, 10-in.
1 Half-round wood rasp, 12-in.
1 Mill bastard file, 10-in.
1 Round file, 12-in., bastard cut
1 Taper file, 7-in.
2 Extra-slim-taper file, 5½-in.
1 Wing divider, 6-in.
1 set Socket firmer chisels, ⅛ to 1½ in.
1 set Irwin bits, ¼ to 1 in. by sixteenths
1 Expansive bit, ⅞ to 3 in.
1 Forstner bit, square shank, ½-in.
1 Forstner bit, square shank, 1¼-in.
1 Ratchet brace, 8-in.
1 Ratchet brace, 10-in.
1 Yankee drill
1 each ½-in. round-shank drills, ⅛, ¼, 3/16, ⅜, ½, ⅝ in.
1 set straight-shank drills, Nos. 0 to 60
1 Chuck, ½-in. round shank, 0 to ⅜ in.
2 Oilers
2 Bar clamps, 36-in.
4 C clamps, 8-in.
4 Hand screws, 10-in.
4 Putty knives
2 Glass cutters (red devil)

Electrical (for 5 pupils)

1 Ball-peen hammer, 1½-lb.
1 Bell-faced claw hammer, 12-oz.
3 Screw drivers, 4-in.
2 Side-cutting electricians' cutters, 6-in.
1 Hack-saw frame, adjustable
6 Hack-saw blades, 10-in.
1 Voltmeter
1 Ammeter
1 Bell-ringing transformer
5 Porcelain receptacles
3 Sockets, push-button
2 Sockets, snap
2 Socket, pull-chain
2 Doorbells
1 Buzzer
2 Entrance switches
2 Snap switches
1 Three-way switch
1 Motor, ¼-h.p.
Small amount of wire, as required. Use shop meter for reading practice.

Plumbing

1 Pipe die stock and dies, ¼, ½, ¾, 1, 1¼, 1½, 2 in.
1 Pipe cutter, ½ to 2 in.
1 Pipe wrench, 10-in.
1 Pipe wrench, 18-in.
1 Adjustable wrench, 8-in.
2 Pliers, 6-in.
1 Hack-saw frame, adjustable
6 Hack-saw blades, 10-in.
1 Ladle, 3-in.
1 Plumber's furnace, No. 2
2 Blowtorches, 1-qt. capacity
1 Metal pot
1 Ball-peen hammer, 2-lb.
1 Pipe reamer, square shank
2 Folding rules, metal, 6-ft.
4 Assorted calking chisels

Sheet Metal (for 5 pupils)

4 Straight snips, No. 8
1 Curved snip
1 Riveting hammer
1 Raising hammer
1 Set of grooving tools
1 Flaring hammer
1 Setting-down hammer
3 Scratch awls
1 Steel square
3 Hollow punches
2 Tinners' mallets
1 Dividers, 10-in.
1 pr. 2-lb. Coppers
1 Rivet set, No. 7
2 Mill files, 8-in.
1 Hatchet stake, No. 5
1 Hollow mandrel, No. 0
1 Needle-case stake
1 Common square stake
1 Beakhorn stake, No. 2
1 Blowhorn stake

Concrete Work (for 5 pupils)

1 Mixing board (make in shop)
2 Shovels, square
1 Water bucket
2 Tamping tools (make in shop)
1 Finishing trowel
1 Pointing trowel
1 Edger
1 Groover
1 Wood float (make in shop)
1 each ¼, ½, 1 cu. ft. measuring box (make in shop)
Forms as needed (make in shop)

Mechanical Drawing (for 5 pupils)

5 Drawing boards, 16 by 20 in.
2 T squares, 20-in.
5 Scales, architects' triangular
3 Triangles, 6-in., 30–60 degree
5 Triangles, 6-in., 45 degree
5 Combination divider pen-and-pencil compasses
2 Ruling pens (medium)

A Practical General-Shop Plan

Earl S. Miller

Horace Mann Junior High School,
San Diego, California

The system described here has been found to work well in classes which originally were limited to 26 students, but which now have been increased to 34.

BOYS of the junior-high-school age are normally from 12 to 15 years old. During these years, boys pass through most difficult physical and mental changes. Their minds are upset by perplexing problems. They are bewildered by the fickleness of their voices which may change in the middle of a word. There is an unproportional physical growth which makes their hands or feet suddenly seem entirely too large. Daydreaming of the future furnishes many hours of pleasant adventures for these boys, but it also increases their problems with their immediate surroundings.

The flexible program of a general shop meets the needs of the adolescent boy very satisfactorily. But the instructors of these junior-high-school boys should be selected on the basis of their knowledge of boys and sympathy for them, not merely on their knowledge of

industries. The BOY is the big item in education. His vocation is important, but it is not the most important part of his education. Furthermore, vocations are constantly changing and becoming so specialized that they are losing their importance as such. For this reason the instructors should understand and like boys as they are. They should be men who are equipped with professional training which enables them to help solve the boys' problems. Their *aim* should be to teach the boys to do better those things that life will ask them to do anyway. Human nature is too diversified to even attempt to cast the boys in a single mold, even if there was one that represented a perfect type of American.

The professional training of men who teach junior-high-school boys, should include a degree, and be of such a general nature that they are able to teach other subjects than shop, and to act as counselor. They should possess that professional attitude toward their vocation that prompts them to secure membership in educational organizations, to read professional magazines, to attend educational meetings. The more equipment the teacher has, the less equipment the school must furnish. The more head, the less overhead.

They also must be fully cognizant that there are definite objectives for their work and that these objectives may be summarized as follows:

1. To develop character, good citizenship, and the spirit of co-operation through enterprises such as building models of boats, airplanes, or gliders, the construction of a canoe or large boat, the repairing of Christmas toys for poor children, the entering-into of school activities, etc.
2. To give information and training that will be valuable to the boy when he grows older, regardless of the vocation or profession he may choose.
3. To expose the boy to as many manipulative experiences as possible through the repairing of household articles.
4. To give the adolescent child a more definite understanding of his industrial environment.
5. To help the child realize what industrial abilities, interests, and capacities he may possess.

The teacher also must plan his work so that he can handle it efficiently. For instance, for the beginning of each shop period, there may be scheduled a five-minute lecture, a demonstration, or special talks by the boys. This should be followed by practical applications made by the student with the aid of job sheets. The progress of the class should be frequently determined by a carefully arranged testing program.

The course of study offered in a general shop should and can depend more on the individual, rather than on a grade or a group classification.

Job sheets are used as a basis of the shop program. These are divided into four departments. They are glued into heavy folders, one face up, another (of the same thing) face down. The folders are labeled and numbered in large letters for their respective departments as WOOD NO. 1, METAL NO. 12, ELECTRICITY NO. 3, GENERAL NO. 8, etc.

The boy does the work first, turns it in and gets a grade on his mechanical work. This grade may be placed on a small pad, and later entered on the boy's card, or it may be entered on the card at once. He then writes the answers to the questions contained in the job sheet on a piece of scratch paper, and receives a grade on this. Later on, he is required to recopy this in a permanent notebook.

The class is divided equally into departments. The completion of a certain number of job sheets, with answers, is required of each boy before he can pass into the next department. A seventh-grade boy, for instance, must finish five jobs in wood before he can pass to metal, electricity, or general. An eighth grader is required to do eight, and a ninth grader must complete ten in all departments before he is permitted to use a lathe, saw, jointer, or other power machine.

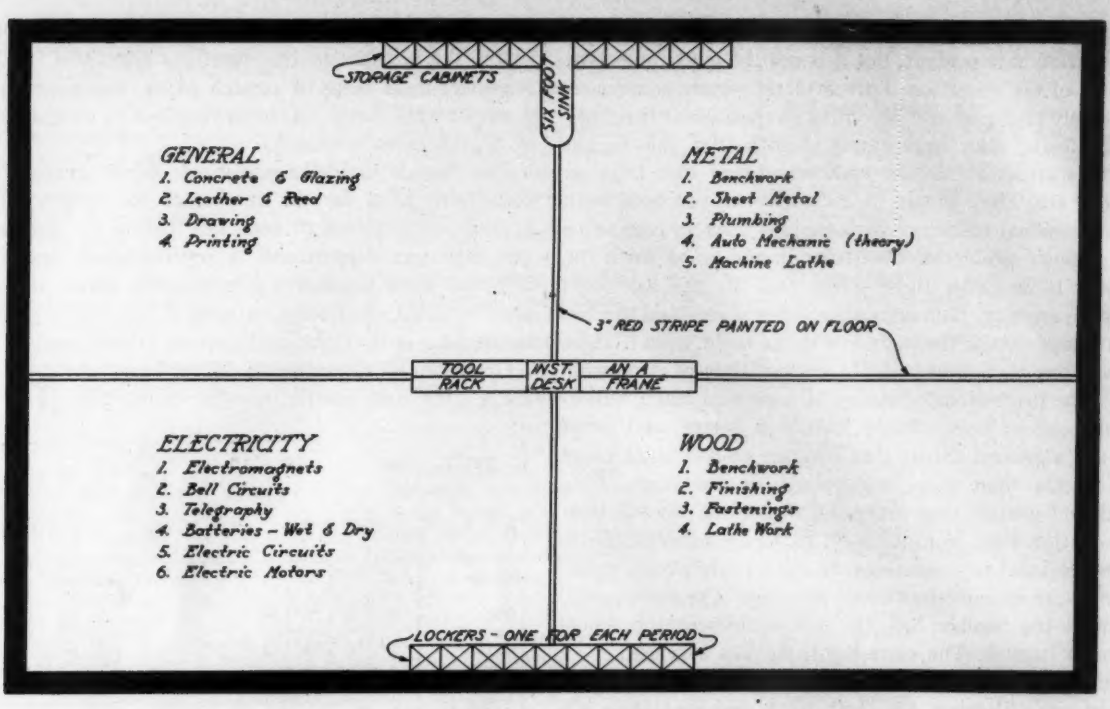
Smith, John (Name)		12 - 13 (Age)				I-III (Period)					
L-7 C C C		H-7 B C B				L-8 B B B				H-8 A B A	
Elect.	$'1^2$	$'2^3$	$'3^2$	$'4^2$	$'5'$	2^62	$'7'$	$'8^3$	$'9^2$	$'10'$	
Gen.	$'1^2$	$'2^3$	$'3^2$	$'4^2$	$'5'$	$'6^3$					
Metal	$'1'$	$'2^3$	$'3^2$	$'4^3$	$'5^2$						
Wood	$'1'$	2	3								
Extra Work--Weeks: Tool-room	III										
Extra Work--Weeks: Stage Work											

Fig. 1. A 4 by 6-in. individual class card

The card shown in Figure 1 presents at a glance the boy's total amount of work, his grades, and his interests. It is easily transferred to different periods. It is an *individual* index to one boy in the shop working under the same conditions in all departments under the same instructor. It is a 4 by 6-in. card upon which the grade the boy receives for his mechanical work is placed on the right of the job-sheet number, and the grade for his answers on the left. The cards are kept in a box with sufficient compartments for each period of the day.

The floor plan for the shop, which should be about 30 by 50 ft., will vary greatly with conditions. Divide the shop into four departments, allowing more space for metal and wood, than for the other subjects. Instead of building partitions or other obstructions, paint a bright-red line on the floor about 3 in. wide. One line should run straight down the length of the shop, another across the shop.

The tools for each department are kept in their respective departments and painted different colors to avoid misplacement. Thus the rack and all the tools for electricity may be painted red with a black outline under the tools, green for metal, yellow for wood, and blue for general. The tool racks or A frames may



The floor plan of a practical General Shop

be built about 2 ft. wide at the bottom, 4 ft. high, and long enough to accommodate all the tools laid out singly. One rack will be sufficient for the shop if it can be placed on the intersection of red lines. Half an A frame may be built in each department if wall space is available, but tools are not checked as easily at the end of each period.

An instructor should never be crowded out, nor his personal system and influence be interfered with by another instructor in the same shop. If the enrollment is large enough, another room and another instructor should be used. If three instructors are necessary for the industrial-arts classes, it might be well to combine mechanical drawing and printing for the third group.

The following is a suggested list of equipment for a general shop. It costs about $2,500, and has proved very satisfactory. Individual tool selections, however, will vary greatly with your conditions. It is well to have a variety of tools and equipment, as this makes demonstration talks more interesting.

EQUIPMENT

Woodshop Equipment

Saws
- 2 Crosscut Saws, 22 in. long, 10 point
- 2 Ripsaws, 22 in. long, 6 point
- 1 Compass
- 2 Backsaws
- 3 Coping-Saw Frames
- 36 Coping-Saw Blades

Planes
- 4 Jack Planes
- 4 Block Planes
- 2 Spokeshaves

Chisels
- 1 each Firmer Socket, ¼, ⅜, ½, ¾, and 1 in.
- 1 Framing Socket, ⅜ in.
- 2 Gouges, socket, 1 in.
- 2 each Tanged Turning Gouges, ½ and 1 in.
- 1 each Tanged Turning Chisels, ½ and 1 in.
- 1 Parting Chisel or Tool
- 1 set Carving Chisels
- 1 Scraping Chisel, ½ in., round nose

Knives
- 6 Sloyd Knives
- 1 Drawknife, 8-in. blade
- 1 Hatchet, claw

Laying-Out Tools
- 12 Steel Rules, 24 in.
- 6 Try-Squares, metal beam
- 1 Framing Square
- 2 Marking Gauges
- 2 Dividers, 6-in. spring
- 4 Compasses
- 1 T Bevel, 6 in.
- 1 Bit Gauge
- 1 pr. Trammel Points
- 1 Caliper, inside, 6 in., 75
- 1 Caliper, outside, 6 in.

Holders
- 1 each Braces, 8- and 12-in. sweep
- 2 Hand Drills

Bits
- 2 sets Auger Bits, ¼ to 1 in., by 16ths
- 1 Expansive Bit, ⅜ to 1¾ in.
- 1 Forstner, ⅜ in.
- 2 Rose Countersinks, ½ by ⅜
- 1 each Screw-Driver Bits, ¼, 5/16, and ⅜ in.

Holding Tools
- 12 Vises, continuous screw, solid nut
- 12 Bench Stops
- 4 each Hand Screws, parallel clamps, Nos. 0, 1, and 22
- 6 General-Purpose Clamps
- 6 Cabinet Clamps
- 1 Miter Box

Driving Tools
- 6 Claw Hammers, 3 each Nos. 12 and 13
- 1 Adz
- 1 Tack Hammer
- 2 Mallets
- 2 each Screw Drivers, 2, 4, 6, 8, and 12 in.
- 2 Nail Sets, small and large

Scrapers
- 2 Cabinet Scrapers
- 2 each Wood Rasps, 10 in., square, half round, flat

Machines and Benches
- 2 Wood-Turning Lathes, 60-in. bed
- 1 Table Saw
- 1 Band Saw, 14 in., with guard
- 14 Workbenches, tops 2 by 24 by 72 in., height 32½ in.
- 4 Workbenches, top 2 by 36 in. by 12 ft., height 32 in.

Finishing
- 6 Bottles, gallon, clear glass
- 12 Paint Brushes, 3 each, ½, ¾, 1, and 1½ in.
- 12 Art Brushes, assorted sizes
- 1 each Oilstones
- 1 Glue Pot

Metal-Working Equipment

Cutting Tools
- 2 Hack Saws
- 1 set Pipe Stock and Dies
- 1 Pipe Stock and Die, ⅛ in.
- 1 set Screw Plates
- 1 Pipe Reamer
- 2 each Files, mill bastard, 4, 6, and 10 in.; half-round, 4, 6, and 10 in.; square, 4, 6, and 10 in.; horse rasp, 10 in.; taper, 3, 4, and 6 in.
- 2 each Cold Chisels, ½, ¾, and 1 in.
- 1 set Drill in steel block, 1/16 to ½ by 64ths
- 1 set Drills in wood block, wire gauge 1 to 60
- 5 pr. Tin Snips
- 1 pr. Tin Snips, circular
- 1 each Hollow Punches
- 1 Bearing Scraper
- 1 doz. Saw Files

Laying-Out Tools
- 2 Tinners' Prickpunches
- 6 Tinners' Scratch Awls
- 1 Wire Gauge, Standard
- 1 each Punches, points ⅛ and ¼, center pin, solid
- 1 set Steel Figures
- 1 set Steel Letters
- 1 First-Aid Kit
- 1 Micrometer
- 1 each inside and outside Calipers
- 1 Hermaphrodite Caliper
- 1 Spirit Level
- 1 Screw and Wire Gauge
- 1 Saw Set, adjustable
- 4 Dividers, 6-in.
- 1 Thickness Gauge
- 6 Steel Rules, 12 in.
- 4 Try-Squares, 9-in. blade
- 1 Combination Square, 6-in. with center
- 2 Framing Squares

Hammers and Holding Tools
- 1 each Ball-Peen Hammers, 8, 12, and 16 oz.
- 2 Riveting Hammers
- 1 Cross-Peen Hammer, Engineers', 2-⅝-lb.
- 1 Flaring Hammer
- 2 Tinners' Mallets
- 6 Machine Vises
- 1 Pipe Vise
- 1 Saw Clamp
- 1 Bench Plate
- 1 Drill Block
- 1 Monkey Wrench
- 1 each Adjustable Wrench, 4, 6, 8, 10, and 12 in.
- 1 set End Wrenches
- 2 each Pipe Wrenches, 6, 10, and 14 in.
- 1 Valve Lifter
- 1 pair Expansion Pliers
- 1 kit Ignition Wrenches

Hand Tools and Hand Machines
- 2 Steel Brushes, curved handles
- 1 each Hand Groovers
- 2 pair each Soldering Coppers, 1, 2, and 3 lb.
- 1 doz. Soldering-Copper Handles
- 1 Valve Grinder
- 1 set of 5 Ezy-out
- 1 Wheel Puller
- 1 Anvil
- 1 Bench Former
- 1 Bench Bar Folder
- 1 Bench Burring Machine
- 1 Bench Turning Machine
- 3 Gas Soldering Furnaces
- 4 Oil Cans
- 1 Breast Drill
- 1 each Screw Driver, 6 and 12 in.
- 1 Beakhorn
- 1 Candle Mold
- 1 Double Seamer with heads
- 1 Hollow Mandrel
- 1 pr. Handy Seamers

Machinery
- 1 Drill, bench type, ½-in. heavy duty, with bench stand
- 1 Grinder, Electric, bench type, 8 by ¾ in. wheels, one fine, one coarse
- 1 Automobile Chassis, complete that will run on its own power
- 1 Machine Lathe, 13¼-in. swing, bench type, with countershaft, complete with following:
  - 1 Universal Chuck, 6 in.
  - 1 Chuck Back, fitted
  - 1 Turning Tool, r.h.
  - 1 Cut-Off Tool
  - 1 Boring Tool
  - 1 Drill Chuck
  - 1 Drill Chuck Arbor
  - 1 each of three different types of Tool Holders
  - 1 each Lathe Dogs, 1, 2, and 3 in.
  - 1 Knurling Tool
  - 5 Tool Bits, high-speed steel, assorted

Electrical Equipment

Bell Circuits
- 6 Bells
- 6 Buzzers
- 6 Push Buttons
- 1 Magnetic Compass

Lighting Circuits
- 6 Fuse Blocks, porcelain base
- 1 each Switches, all varieties of knife switches
- 1 each Light Sockets, all varieties
- 1 each Snap Switches, all varieties
- 2 each Plugs, two-piece, swivel, etc., all varieties

Telegraph
- 1 Sounder
- 1 Key

Equipment
- 1 Bell Transformer
- 1 Transformer, special, range from 3 to 24 volts
- 2 Gas Soldering Furnaces
- 1 Blowtorch
- 1 Volt Ammeter
- 1 Charger, 4-battery Tungar
- 1 Cell tester
- 1 Gallon Battery Filer
- 2 Hydrometers
- 1 Battery Post Drill
- 1 Burning Rack, Plate
- 1 Set Battery-Post Builders
- 1 Group Puller

Tools
- 6 each Side Cutters
- 2 each Screw Drivers, 2½, 4, and 6 in.
- 6 Sloyd Knives
- 2 pr. each 1- and 2-lb. Soldering Coppers
- 3 pr. Pliers, combination
- 1 pr. Cutting Nippers

Printshop Equipment

Machinery
- 1 Press, Platen, 8 by 12 in., complete with one set of cast rollers, chase, and wrench
- 1 Hand Roller, 6 in.

Furniture
- 3 Case Racks wood construction, each with 2 prs. brackets
- 13 California Job cases, plain-lip front
- 1 Lead-and-Slug Case, plain-lip front
- 1 quarter-size Rule Case
- 1 Marble Surface, 1 by 12 by 18 in.
- 1 Elementary assortment Wood Furniture and reglets

Miscellaneous
- 6 Pressed-Steel Galleys, 6 by 10 in.
- 1 Pressed-Steel Galley, 8¾ by 13 in.
- 6 Composing Sticks, 6 by 2 in.
- 1 Pica Stick, 8 by 2 in.
- 1 Benzine Can, pint size
- 1 Oval-Back Benzine Brush
- 1 Hickory Mallet
- 1 Planer
- 1 Proof Planer
- 12 Steel Quoins No. 1
- 1 Quoin Key
- 1 18-in. blade Paper Cutter
- 1 doz. Spring-Tongue Gauge Pins
- ¼ lb. Job Black Ink
- 1 set "Visual Aids in Printing"
- 10 lb. 2-pt. Leads, labor saving
- 10 lb. 6-pt. Slugs, labor saving
- 1 lb. 2-pt. labor saving Brass Rule
- 1 font 2-pt. Miters for Rule

Type, Spaces and Quads
- 1 font 8-pt. Schoolbook Oldstyle
- 40 lb. 10-pt. Schoolbook Oldstyle
- 1 font each, 12-, 18-, and 24-pt. Schoolbook Oldstyle
- 1 font each, 8-, 10-, 12-, 18-, and 24-pt. Century Schoolbook Bold
- 2 fonts 8-pt. Spaces and Quads
- 15 lb. 10-pt. Spaces and Quads
- 2 fonts each, 12-, 18-, and 24-pt. Spaces and Quads

Miscellaneous Equipment
- 1 Instructor's Desk

4 Chairs, oak
1 Blackboard, 4 by 12 ft.
12 Stools, round tops
4 each Drawing Boards, T squares, 45- and 60-deg. angles
6 pr. Scissors, 4- and 6-in. cutting edges
2 doz. Bench Brushes
2 Glass Cutters
2 Pointing Trowels
1 5-lb. can Cup Grease, soft
1 Tape Line, 50 ft., linen
1 Belt Punch, revolving
1 Safety Benzine Can
1 Shoe-Repair Set

SUPPLIES

Woodshop Supplies

1000 board feet, mill run, 1-in. Sugar Pine, S2S
200 board feet, mill run, 1-in. Oregon Pine, S2S
200 board feet, mill run, 2-in. Sugar Pine, S2S
100 board feet, mill run, 1-in. Mahogany, S2S
100 board feet, 1-in. Oak
100 sq. ft., 3-ply Veneer, Oregon Pine, ¼ by 24 by 48 in.

Screws

2 gross each Wood Screws, r.h. and f.h., ½ No. 2, ½ No. 4, ¾ No. 4, ¾ No. 6, 1 No. 6, 1½ No. 6, 1½ No. 8, 2 No. 8, 2 No. 10, and 2½ No. 10
2 gross each Corrugated Fasteners, No. 5, divergent, ¼, ⅜, ½, and ¾ in.
1 gross each Corrugated Fasteners, No. 5, parallel, ½ in.

Nails

5 lb. each Nails and Brads, ⅞ — 16, 1½ — 14, 2 — 12, 2½ — 10, 3 — 9, and 4 — 6
1 lb. each Nails and Brads, ¼ — 22, ½ — 20, and ¾ — 18
1 gross each Screw Eyes, bright with ⅛, ¼, ⅜, and ½-in. hole
3 reams Sandpaper, No. 1½
1 Ream each Sandpaper, No. ½, 0, and 00
1 Gross each Carriage Bolts, ¼ by 1, ¼ by 1½, ¼ by 2¼, and 5/16 by 2½ in.
100 each r.h. Stove Bolts, ⅛ by ½, 3/16 by 1, ¼ by 1½, and ¼ by 2½ in.
1 doz. Dowel Rods, ¼, ⅜, ½, ¾, birch
8 pt. cans Liquid Glue
5 lb. Cold-Water Glue, powdered
5 lb. Chipped or Flaked Glue, for hot gluing

Finish

2 gal. Denatured Alcohol
2 gal. Boiled Linseed Oil
2 pails Flat White Paint, ½ gal. each
2 qts. each Enamel, red, white, black, blue, green, yellow, ivory
5 gal. Turpentine
1 gal. Black Asphaltum Paint
2 pails White Lead, 5 lb. each

Metal-Working Supplies

Machine Shop

6 each 3-ft. lengths, Bessemer Rods, ⅛, 5/32, 3/16, and ¼ in.
2 each 20-ft. lengths, Cold Roll, ¼, 5/16, ⅜, 7/16, ½ round
1 each 20-ft. lengths, Cold Roll, ¾, 1, and 1½ in.
1 each 20-ft. lengths, square, Soft Steel, ¼, 5/16, and ½ in.
3 gross each Iron Hex Nuts, 6/32 and 8/32 in.
100 each Iron Nuts, U.S.S. and S.A.E., 3/16, ¼, 5/16, and ½ in.
2 gross each Machine Screws, r.h., ¾ in. — 6/32, 1 in. — 8/32
1 lb. each Washers, ⅛, 3/16, ¼, 5/16, and ½ in.

Sheet Metal

4 only ½ blocks Salammoniac
2 boxes Tinners' Rivets, 1 lb.
15 lbs. Wire Solder, ⅛ in.
2 bars 50-50 Solder
2 spools Acid Center Solder, small size
2 qts. Muriatic Acid
2 sheets Zinc
1 doz. cans Soldering Paste
1 stone each Annealed Steel Wire No. 14, 16, and 20
50 sheets Charcoal Tin, 20 by 28 in., lc-l
4 sheets Galvanized Tin, large size, 24 gauge
5 coils of Stovepipe Wire, plain
2 coils ¼ lb. each, Music Wire, No. 8, 12, and 16

Plumbing

2 each 20-ft. lengths Iron Pipe, ⅛, ¼, ⅜, ½, and ¾ in.
2 doz. each Washers, compression, fuller-balls

Auto Mechanics

6 cans Valve-Grinding Compound, coarse and fine
2 bales Rags, 50 lb. each
4 Oilstones
1 gal. medium Cylinder Oil
1 gal. 600-W Grease
10 lb. Soft Cup Grease
6 cans Rubber-Tire Patches, cold, monkey grip
10 lbs. Adding Material for Welding Cast Iron
1 bale Waste, 50 lb.
5 lb. Grained Carborundum
Hack-Saw Blades

Electrical Equipment

4 spools Annunciator Wire, copper, 6 to 8 lb. No. 18
1 coil, 500 ft. No. 19, B and S, twisted pair, Copper Wire
1 coil, waterproof Copper Wire, No. 16, wt. 20 lb.
1 each spool cotton-covered Enameled Copper Wire, B and S, 20 and 22 gauge
10 lb. Coppered Staples, ½ in.
5 pkgs. Insulated Staples, ¾ in.
6 pkgs. Friction Tape
3 pkgs. Rubber Tape
2 Lamp Guards, standard portable
2 doz. each Porcelain, Split Knobs, Cleats, Tubes
1 box Battery Clips, 10 amp.
25 lb. Sealing Compound for Storage Batteries
100 lb. Lead
5 gal. Sulphuric Acid, 1.400 gravity
10 gal. Distilled Water
1 doz. Dry-Cell Batteries
1 doz. each Fuses, 10, 15, 20, and 30 amp.

Printing Supplies

500 sheets White Drawing Paper, 24 by 36 in.
500 Cut Cards
100 sheets White Stock, 25 by 38 in.
1 ream Newspaper
25 each 2-ply Bristol Cardboard, pink, green, blue, buff
6 tubes, small, Printers' Ink
1 roll Wrapping Paper, 36 in. width
1 Paper Rack for 36-in. wrapping paper
100 sheets Proof Paper, rice
25 sheets Gummed Paper, buff
100 sheets Tympan Paper
1 set A.B.C. Rubber Stamps, 1-in. letters and numbers
1 box Gummed Labels, 2 by 4 in.
200 Manila Folders, heavy, 9 by 12 in.
1 box Fasteners, ½ in.
5 boxes Paper Clips
2 boxes Rubber Binders
12 boxes Thumb Tacks, No. 2

Miscellaneous Supplies

Leather

10 lb. Tooling Leather, for pocketbooks
2 lb. Thin Leather for pocketbook lining
1 doz. Leather Soles for shoes
2 boxes each Shoe Nails, ⅜, ½, and ¾ in.

Reed

2 bundles ⅛-in. Round Reed
10 lb. each ¼-, ⅜-in. Round Reed
1 bundle ¼-in. flat reed
1 sack Cement
6 Window Lights, plain glass, about 24 in. square
5 lb. Whiting
2 boxes Glazier's Points

A general shop depends greatly on the community, on the instructor, on shop facilities, and on the principal.

The community must be more favorable to a course in general industrial education of the children, than in the pieces of furniture that the boys bring home from the school shop. Boys must learn to walk before they can run, and so it is with the work they do. The

activities should be appropriate to the boy's age. Difficult enough to challenge his best effort, but simple enough to provide a feeling of accomplishment.

The instructor is the shop. Unless he is working under difficulties over which he has no control, his shop represents his interests, abilities, progressiveness, and capacity in accomplishing results. A general shop requires much teacher effort because of individual nature of the instruction, but the individual is the important item. The secret of a successful general shop is to develop a bullet-proof system and have the students do much of the work. Boys properly supervised, can correct all the papers, enter all the grades, act as monitors or foremen in departments, and take care of the toolroom, giving special instruction with the special tools if required.

Shop facilities and the principal must be favorable. A good principal with a poor shop is much better than the reverse. Conditions vary greatly; even our ideals differ at different levels of development. The test of one's intelligence is registered in the amount of truth that develops from the solution of one's problems.

SHOP MANAGEMENT

Tool Records Determine Needs

Noel B. Grinstead

Central Missouri State Teachers College, Warrensburg, Missouri

The study made by the author provides excellent data for the person who is confronted with the job of equipping a woodworking department with the necessary hand tools. Similar studies based on this one, made in other school shops, would be equally helpful.

THIRTY-SEVEN thousand tools were checked out to six hundred students over a period of five years in the woodworking shop Central Missouri State Teachers College. The classes selected to make the check record were typical of those which work with the equipment regularly. They included grades 8, 10, and 11 of the training school under student instructors, classes in elementary and advanced (hand) woodworking, and elementary industrial arts for girls in college. The latter course is offered primarily for those who will teach in the elementary grades or in rural schools. The distribution, was as follows:

Eighth grade	50 students
Tenth grade	200 students
Eleventh grade	100 students
College woodwork	100 students
Elementary industrial arts	150 students

The purpose of the check was to test the validity of an often repeated statement that tools are selected more on a historical or previous-experience basis rather than on a scientific basis. The record was kept intermittently, sample classes having been selected largely on two bases: the variety of work which would be possible from the personnel of the group, and a size of class which would afford sufficient data for experimental value. The projects constructed by the experimental groups were, in general, of student selection and in conformity with rough classified groups of projects suggested by the teachers in the development of course material set out in the Missouri Bulletin No. 4, on *Industrial Subjects*. This bulletin contains analyses and suggestions very similar to those worked out by the A.V.A. standards committee.

This particular woodworking shop has a tool checkroom in which all tools except jack planes, mallets, and clamps are kept. Each student is issued a jack-plane iron and consequently there is no record of the use of that tool. It has been assumed that there should be one plane or plane iron for each individual, although there is no record to substantiate that belief. The class member who served as clerk in the checkroom issued tools and recorded on a printed form the name or number of the borrower; the name, size, and kind of tool issued; checked the tools off the list as they were returned, and filed the day's entry at the close of the period.

Table I shows the number of times each tool group, such as "squares" or "hammers" was used, and its numerical rank is a comparison with other groups as to frequency of use. The first several groups present a picture that might be more or

TABLE I. RANK AND INDEX VALUE OF ALL WOODWORKING TOOLS

Rank	Name of Tool	Frequency	Per Cent	Index Value	Per Class of 30
1	All squares	9012	24.07	1.0	30
2	All rules	7007	18.9	.75	22
3*	All chisels	3557	9.5	.45	14
4	All saws	2290	6.12	.25	8
5	Planes (except jack)	1844	4.92	.2	6
6	Gauges	1623	4.37	.2	6
7	Scrapers	1782	4.76	.2	6
8*	Bits	1636	4.37	.2	6
9	Rasps	1548	4.13	.17	5
10	Hammers	1539	4.11	.17	5
11	Screw drivers	1245	3.32	.14	4
12	Braces	1030	2.75	.12	3-4
13*	Carriage clamps	576	1.54	.07	2
14	Scissors	377	1.0	.04	2
15	Gouges	352	.94	.04	2
16	Knives (bench)	350	.93	.04	2
17	Files	238	.63	.03	1-2
18	Pliers	220	.59	.03	1-2
19	Wire brush	212	.56	.03	1-2
20	Hand drill	209	.55	.03	1-2
21	Nail set	107	.28	.04	1
22	Dividers	104	.27	.04	1
23	Bit gauge	99	.26	.04	1
24	Spokeshave	94	.25	.04	1
25	Doweling jig	43	.11	.04	1
26	All others	138	.37	.04 or	1 each
	TOTALS	37,431	100.0		

* See detailed tables and explanation

less anticipated by the experienced woodworking teacher. Such a teacher, however, might not be aware of the fact that the first five groups include more than 60 per cent of all tools used, exclusive of jack planes, and that in an original list of 37 groups, nearly 85 per cent of the total are found in the first ten.

Some of the practical values of the tabulation are obvious. It may afford a tangible guide for the selection of tools in the shop if we devise a simple scheme whereby we may assign numerical values or constants based on percentage of total use to the several schools. If it may be assumed that the high percentage group (squares) should be furnished on the basis of one to each person, the value of that group would be 1, the constant or index of a group of tools which was used 24 per cent of the total of all tools combined. Rules were used 18 per cent of the total for all tools, so their value or index would be 18/24 or ¾ of squares, giving them a constant of .75. In other words, there would be 75 per cent as many rules as there are students to be accommodated, or, as shown in the table, we would furnish 22 rules and 30 squares for a class of 30 students. It may be seen that a teacher, particularly one who is inexperienced, might list all the tools that he deems necessary for successful operation of a shop, look up the index value of each tool or tool group, and multiply that number by the number of students that the toolroom is intended to serve at any given time. Where the result involves fractions, he may increase or decrease the number of tools as he sees fit.

TABLE II. DISTRIBUTION OF KINDS OF SQUARES

Rank	Kind of Square	Frequency	Per Cent of Grand Total	Index Value	For Class of 30
1	Try-square 6" 7276 3" 75 8" 65	7416	19.81	.8	24
2	Steel Square *16x24 1244 8x12 76	1320	3.53	.14	4
3	? Bevel	276	.73	.06	2
	TOTALS	9012	24.07		30
	*Framing Square				

TABLE III. DISTRIBUTION OF SIZES OF CHISELS

Rank	Width of Blade	Frequency	Per Cent of Chisels	Index Value	For Class of 30
1	3/4"	1132	31.81	.14	4
2	1/2"	933	26.22	.12	3-4
3	1"	538	15.12	.07	2-3
4	1/4"	459	12.9	.07	2
5	3/8"	280	7.9	.06	2
6	1/8"	75	2.1	.04	1
7	No size given	140	3.95		
	TOTALS	3557	100.0		14-16

Two major discrepancies of Table I should be pointed out. It is obvious that there must be more than four bits, and more than two carriage clamps. Bits, such as auger or gimlet bits, although not used very frequently, must be carried in all the sizes that are likely to be used in order to meet all the conditions of normal woodworking activities in the shop. If there were only one size of bits, as there could be of try-squares, the number given in the table would be sufficient if the frequency of use is a suitable criterion. The same thing might be pointed out with reference to a number of tools which are seldom used, but are very important when they are needed. Carriage clamps are not used often, but when they are required two or more may be needed, or possibly the clamps must be allowed to remain on the work for several hours. Hand-screw clamps, which are sometimes used in preference to carriage clamps for a majority of jobs, were available outside the checkroom, thereby reducing the number of carriage clamps that would be demanded in this shop.

A natural question is, how may we break up the general term "squares" into its elements of try-, framing, bevel, and so on. Table II shows that try-squares are used much more than any other square, and in addition we get a fair comparison as to the popularity or need of various lengths of blades, the more or less standard 6-in. length proving to be in much greater demand than other lengths. We have no assurance that the preference would be the same if there were as many of the other two sizes available. Now in Table I, we found that there would be 30 squares for 30 boys, whereas more accurately we might divide this number so that there would be 24 try-squares, 4 framing squares, and 2 T bevels. In just the same manner we may find out what size of chisel is used most and should be bought in largest quantities, Table III being arranged to show the ranks of six sizes of chisels. The ¾-in. width, which is one of the paring width, was the most commonly used, followed by the ½-in. which is used for mortising, trimming, and paring. It may be somewhat surprising to note the low ranking of the ⅜-in. chisel, especially because it is used a great deal in hand mortising. Subsequent checks indicate that there may have been some confusion in recording the two sizes, ¾ in. and ⅜ in., although there is no proof at hand. In 140 cases out of a total of 3557 chisels checked out, the width of the blade was omitted from the records.

Table IV shows the comparison between the different kinds of bits used, and gives data which is more useful than that in the summation of all bits in Table I. However, it is not yet possible to assign accurate values because there are so many needed sizes of the various kinds of bits, and even though a certain size and kind is used infrequently, there must be one of each size at hand. The detailed analysis of auger bits, set out in Table V, explains why the number given in Table I may be in error. There were no recorded calls for a No. 11 auger bit, and few calls for several other sizes. It is evident that not more than two of the No. 4 size, checked out 51 times, would be required, for this number is only 12 per cent of the total of all auger-bit uses. Then the value assigned to the No. 6 is simply a matter of arithmetic, the latter size being used 37 per cent of the auger-bit total. Forstner bits rank as follows in the order of frequency of use: Nos. 8, 6, 12, 4, and 16, 14. Gimlet bits rank Nos. 4, 6, 7, 8, 9.

The material for Table VI, on saws, is worked out in similiar manner, but the index values are taken from the master

TABLE IV. DISTRIBUTION OF KINDS OF BITS

Rank	Kind of Bit	Frequency	Per Cent of Bit Total
1	Auger	400	24.4
2	Gimlet	323	19.7
3	Countersink	297	18.2
4	Twist Drill	252	15.4
5	Forstner	28	1.7
6	Screw driver	18	1.1
7	Expansive	14	.9
8	Not designated	304	18.6
	TOTALS	1636	100.0

TABLE V. DISTRIBUTION OF SIZES OF AUGER BITS

Rank	Size in 16ths	Frequency	Per Cent of Auger Bit Total	Index Value	For Class of 30
1	6	150	37.5	.14	4
2	8	62	15.5	.06	2
3	4	51	12.75	.06	2
4	5	31	7.75	.04	1
5	7	24	6.0	.04	1
6	12	23	5.75	.04	1
7	10	15	3.75	.04	1
8	9	13	3.25	.04	1
9	16	12	3.0	.04	1
10	14	7	1.75	.04	1
11	13	6	1.5	.04	1
12	3	3	1.25	.04	1
13	15	1	.25	.04	1
14	11	0			
	TOTALS	400	100.0		15

TABLE VI. DISTRIBUTION OF KINDS OF SAWS

Rank	Kind of Saw	Frequency	Per Cent of All Saws	Index Value	For Class of 30
1	Coping	1032	45.1	.45	12
2	Hand cross-cut	608	26.5	.2	6
3	Rip	431	18.8	.14	4
4	Tenon	198	8.64	.05	2
5	Compass	12	.52	.04	1
6	Hack	9	.39	.04	1
	TOTALS	2290	100.0		26

table, No. I. The coping saw heads the list largely for the reason that the group of 150 college girls who are preparing to teach handwork in the grades use this tool a great deal. From the data at hand, similar tables could be worked up to show the comparison between the sizes of gimlet bits; Forstner bits; the kinds of hammers — claw, tack, machinist's; the breast drill and hand drill; marking, mortise, and bit gauges; inside- and outside-bevel gouges; carving and bench or sloyd knives; block, circular, fore, and universal planes; and so on, to a most detailed analysis of the entire record. Sufficient is given here to show that a carefully kept tool record is likely to be of great value in judging existing equipment or in the selection of new equipment, or in evaluating the selection of projects that are constructed.

It is well to keep in mind that the equipment requirements of two systems will not be identical owing to differences in offerings, nature of projects emphasized, or even the personal preferences of teachers as regards different methods or kinds and sizes of tools. In the shop where the study was made, there has been a constant decrease in the number of tools which are made available to students, a great many duplicate tools having been retired until they are again needed as a result of the several causes of tool mortality. It is our hope to arrive at an optimum and well-balanced selection of tools in such a way that the work may be carried on without inconvenience or loss of time to the students, and yet so that there are no dead tools in the checkroom. An advantage of keeping the number of tools to a minimum or optimum is that it will be possible to make replacements from new and improved types. It would be a relatively simple matter for an industrial-arts teacher to make a similar check on his own equipment in order to point out his needs or to verify his judgment relative to the purchase of additional tools or to existing surpluses.[1] Eventually wear, breakage, and loss will absorb surpluses, but if they are not detected in some manner an unnecessarily large number of some items may be allowed to persist through a system of progressive replacement. The present study is indicative of the value of a tool record, but quite likely it is too limited in extent, scope, and the control of variables to be highly reliable. It is obvious that the check record may be an indictment of the manner of organizing courses just as well as it might serve as a basis for criticizing an existing equipment, or for guiding one in selecting new equipment.

[1]At the present time, Mr. C. M. Woodstock, graduate student at Central Missouri State Teachers College, is making a similar study in co-operation with the industrial-arts teachers of ten schools in the college district. The results of this study will be available in the spring and will furnish an interesting comparison.

Evaluating Pupils' Work in Shop

Gerald Baysinger
G. Harold Silvius
Earl L. Bedell

Detroit, Michigan

The suggestions contained in this article will be found very helpful by shop teachers in any school shop. The point system for grading will simplify the method of determining the pupil's standing in the work which he is doing.

IT IS a matter of common observation that time has become increasingly important in this workaday world in which we live. "How long will it take to grease my car?" the garage man is asked. "When will my suit be ready?" is the question asked of the manager of the dry-cleaning establishment. The employer asks, "How many shingles can you lay a day?", and "How many words can you type per minute?" The efficiency of an automobile plant is measured in *man-hours* per unit. Our newspapers headline the accomplishment of a reduction in transcontinental flying time. The world is concerned with the business of getting things done.

In the school shop, we have relied upon interest to take care of the business of "getting things done." Dawdling, waste of time, and disregard of time altogether have been found difficult to overcome because pupils have little conception of the value of time and its relation to the job. This unsatisfactory condition is probably the result of the lack of suitable time standards considered in evaluating pupils' work in shop. Shop teachers have concerned themselves with quality only, and time is considered subjectively or forgotten entirely. It is not to be wondered at, then, that pupils have little conception of the value of time.

Time, quality, and their interrelation present a problem in evaluating pupils' work which is difficult to solve. John completes job No. 3 in two hours with a quality of B. George completes the same job in four days with a quality of A. What mark should each receive? There are probably as many answers as there are teachers, and quite likely no two teachers would agree. Our grading system is an inheritance from our academic ancestors; it is certainly not suitable for evaluating pupils' work in shop, and was never intended for this purpose. Two teachers could not agree upon what marks John and George should receive simply because the marking system in current use is concerned with quality only; it is insufficient for considering two variables — time and quality. If we disregard the time element in the example used, we could easily agree upon the marks each boy should receive. The inclusion of time, as an element in the evaluation of pupils' work, demands changes in our current marking system.

The purpose of this article is to present a workable marking system in which time and quality are considered objectively. This plan, which is called the *point system*, will be described in detail.

Standard Time

Standard time is a term borrowed from industry; it means the average time required to do the job. We expect a certain amount of progress, and we specify certain standards of quality or workmanship. Standard time is likewise a standard, which specifies the amount of time in which the pupil is expected to do the job.

Standard time for a job may be determined in several ways. First, the instructor might arbitrarily set a time limit based upon his experience and judgment, as to how much a pupil might be expected to accomplish in a certain amount of time. This probably would be quite accurate, and would need little revision. Second, the standard time may be determined by averaging the time spent on the same job by a previous class. This probably would be sufficiently accurate for most purposes, even though the abilities of the two different groups would vary. Third, the class itself might set the time standard by means of a class discussion and a general agreement.

This method is especially valuable and effective because it tends to create a *time consciousness* in the class. Pupils become interested in the element of time, and attempt to meet the standard.

Quality Grade in Points

The instructor's evaluation of the work done, as to quality of workmanship, is the quality grade. This quality grade is transferred into points: excellent, A, 4 points; good, B, 3 points; average, C, 2 points; poor, D, 1 point; failure, E.

Credit Points

Credit points are obtained by multiplying the standard time by the quality grade in points. A credit point is a unit of credit. Credit points thus become the time-quality evaluation of the pupil's work.

Example: The standard time for a footstool is ten class periods. The quality of workmanship was average or a C.
Solution: The C grade has been assigned a value of two points.
10×2 is equal to 20 credit points.

The Card Mark

The total number of credit points earned during the card-marking period determines the pupils' card mark. The number of shop days in the card-marking period, multiplied by one, two, three, and four, set the limits for determining the mark which the pupil will receive. For example, if there are twenty days in the card-marking period, then:

20×4 or 80 points are required for a grade of A
20×3 or 60 points are required for a grade of B
20×2 or 40 points are required for a grade of C
20×1 or 20 points are required for a grade of D

The reason for this arrangement is obvious. If the pupil earns an A grade, equal to four points, each day for twenty days, he would have a total of eighty points. Less than eighty points would indicate that the work done during the twenty days, was not of A quality.

The example given to illustrate the method for determining the card mark, explains only the method for the first card mark. If it is desired to make the card marks cumulative, then the limits for each successive marking are determined by using the total number of days to date, instead of the number of days in that particular marking period. If, for example, there are 20 days in the first card-marking period, and 25 days in the second card-marking period, then 45 days are used as a basis for determining the limits for the second card mark.

Standard Time for Each Shop Assignment

If the work which the pupil does in shop is to determine his card mark, then credit for all work should be given. A standard time, usually expressed in days or class periods, should be set for each type of shop assignment, so that the proper amount of credit may be determined.

1. *Course-of-Study Jobs*

The standard time for a course-of-study job, is the number of days in which the pupil is expected to do the job. This varies with each job; it includes the time spent by the boy in preparing to do the job as well as actual working time. For example, if the total time spent by the teacher demonstrating the footstool is one day, and nine days are required by the boy to make the stool, then the standard time for the job is ten days.

2. *Personnel Assignments*

There are full-time and part-time pupil personnel assignments. The standard time for a full-time job is the number of days the pupil does that job. For example, the standard time for superintendent, a full-time job performed for one week, is five days. The standard time for a part-time job depends on the total amount of time spent during the week. The secretary, for example, might be required to spend one half of each class period for one week on clerical work. The standard time for this job would be two and one-half days.

3. *Maintenance and School Jobs*

The standard time for a maintenance or school job is the number of days or class periods spent by the pupil doing the job. If, for example, a boy spends four class periods on carpentry work in the auditorium, then the standard time for the job is four days.

4. *Tests and Special Assignments*

The standard time for a test which takes an entire class period is one day. Credit for taking the test is obtained by multiplying the quality grade by one. Special lessons and other assignments may be credited in the same manner.

Late Enrollment

Two methods are suggested to take care of the credits of the pupil who enters after the term is started. First, the card-mark requirements may be adjusted for each particular case by using the number of days the pupil is in attendance multiplied by one, two, three, and four, instead of using the number of days in the card-marking period. For example, a pupil enters late, and at the time the cards are marked has been in attendance fifteen days. His card mark would be determined by the following limits:

15×4 or 60 points for a grade of A,
15×3 or 45 points for a grade of B, etc.

The second method is designed to avoid teacher effort by eliminating the necessity for individual marking of the pupils entering late. A handicap is given to these pupils; it is determined by multiplying the number of days not in attendance by two. This procedure is the same as crediting pupils entering late with a C grade for each day not in attendance.

Excused Absence

The same methods used in determining credit adjustments due to late enrollment, may also be used in compensating excused absence from class. The total number of days each pupil is present may be used as a basis for setting the limits which determine the card mark. It is evident that additional clerical work would be necessary if this method is used, for the limits would need to be calculated for practically every pupil. The second plan provides for a handicap of two points for each excused absence. This arrangement permits the use of the same limits for determining the card marks of all pupils, and for all practical purposes is satisfactory in operation.

Card Mark Determined by Pupil

A record of the total number of points earned by each pupil may be kept by the pupil, or it may be kept in graph form as a class record. The limits are determined by the instructor, and on the day when the card marks are to be made out, each pupil, by comparing his total points with the limits or requirements, easily determines his own mark to his own satisfaction.

Course of Study

The total standard time of assignments outlined in the course of study should be equal to or greater than the number of shop periods in the term. The use of standard time simplifies the task of selecting these assignments by indicating definitely the amount of time that will be spent on each assignment so that stress may be given those of greater importance.

Teachers of shopwork are fortunate in having objective results on which to base their marking. The results of instruction are tangible; quality of workmanship and time spent in doing the job can easily be determined. The point system is a means for accurately measuring the results of instruction in terms understood by the pupil.

Submitted by E. M. Manzer, Bronxville, New York
— Photo, Museum of Fine Arts, Boston, Mass.

Rating Industrial-Arts Teachers

August Flam

John Marshall High School,
Los Angeles, California

The rating scale shown herewith was originally prepared for rating teachers of drafting but it is equally applicable to teachers of other shop subjects.

IN CONSTRUCTING a score card for the rating of teachers, it is advantageous to know intimately as many teachers as possible. The writer began his work on a score card for rating mechanical-drawing teachers by selecting three with whom he was well acquainted, and with whose qualifications, training, experience, and general views on professional and social matters, he was as familiar as it is possible to be after six years of intimate and almost daily contact. However, what applies to mechanical-drawing teachers applies with equal force to woodshop, auto-shop, electric-shop, printshop, or sheet-metal-shop teachers.

The first step is to list as many vital elements that enter into consideration in rating a teacher as one can possibly think of. The long list is then subdivided under main headings. The most difficult part of the task is to give weights to the different elements. Should personal qualifications be considered of greater importance than professional training? How about practical experience in industry? Is it more important than thorough preparation? The writer felt that the answer to these vexing problems is that "the proof of the pudding is in the eating." He therefore rated his friends and himself in advance, and tried out various methods of assigning values to the single elements. Since his friends and he have had decidedly varying kinds of preparation and experience, and since their personal qualifications are by no means alike, it was obvious that if the rating card would fit all of them, it was probably workable. For example, when personal qualifications was assigned a value of 40, and professional qualifications 30, out of a possible 100, the scale was found to be inoperative for three out of the four being rated. The emphasis therefore had to be changed, and values readjusted until the card fitted all four. This shifting of weights was the subject of lengthy experimentation in order to attain a reasonably satisfactory result.

Now, if one is intimately acquainted with a larger number of teachers, say ten or twelve — and if one is sufficiently familiar with their work to rate them A, B, C, etc., and then try out the assigned values, a high positive correlation in results indicates that the rating card is workable.

Another difficulty lies in selecting those elements for rating which are capable of being estimated at least with a reasonable degree of certainty. Such elusive elements as ideals of democracy, understanding of world relationships, insight into the learning process, community interests, etc., which were on the original list, had to be discarded as being too difficult or impossible to evaluate.

The conclusions reached in this study of rating industrial-arts teachers may be summarized as follows:

1. Score cards for rating teachers have of necessity serious limitations.
2. Such a thing as a perfect score card is a myth.
3. The person doing the rating must be intimately acquainted with the teacher being rated.
4. Many important items upon which a teacher ought to be rated are too elusive to be quantitatively measured.
5. The simplest rating card is, in the last analysis, the most usable one, and consequently the best.

The score card developed is given herewith:

I. *Personal and Social Qualifications*			35
1. Personal appearance	4	5. Humor	3
2. Health	4	6. Foresight	3
3. Ability to "carry things through"	4	7. Judgment	3
4. Voice and manner	3	8. Self-respect	2
		9. Self-control	2
10. Tact	2	13. Modesty	1
11. Meeting people and mixing	2	Total	35
12. Sincerity	2		
II. *Professional Qualifications*			40
1. College graduation or equivalent	10	8. Membership in professional organizations	3
2. Capacity in organizing and conducting the learning activities	5	9. Travel	2
3. Courses in education	4	10. Ability to make the subject "live and interesting"	2
4. Teaching experience	3	11. Contributions to the professional educational literature	2
5. Skill in managing recitations	3	Total	40
6. Improvement in service	3		
7. Continued study	3		
III. *Technical Qualifications*			25
1. Thorough mastery of the particular field	10	fields	3
2. Work in industry as draftsman, builder, superintendent, executive, carpenter, etc.	5	5. Ability to get out during normal times and get a job	2
3. Keeping in contact with industry	3	6. Ability to make desirable contacts in the industries for the benefit of students	2
4. Knowledge and appreciation of related		Total	25

Samples of Rating

Teacher No. 1 (considered an "A" teacher).

I.	32	II.	37	III.	22
1.	3	1.	10	1.	10
2.	4	2.	5	2.	4
3.	3	3.	4	3.	2
4.	3	4.	3	4.	3
5.	3	5.	3	5.	1
6.	3	6.	3	6.	2
7.	3	7.	3		
8.	2	8.	3		22
9.	2	9.	1		
10.	2	10.	2		
11.	1	11.	0		
12.	2				
13.	1		37		
	32				

Total: 32 + 37 + 22 = 91 corresponds satisfactorily with original estimate.

Teacher No. 2 (considered a "B" teacher).

I.	34	II.	25	III.	24
1.	4	1.	5	1.	10
2.	4	2.	5	2.	5
3.	4	3.	0	3.	3
4.	3	4.	3	4.	2
5.	3	5.	3	5.	2
6.	3	6.	3	6.	2
7.	2	7.	1		
8.	2	8.	1		24
9.	2	9.	2		
10.	2	10.	2		
11.	2	11.	0		
12.	2				
13.	1		25		
	34				

Total: 34 + 25 + 24 = 83 corresponds satisfactorily with original estimate.

Teacher No. 3 (considered a "C" teacher).

I.	29	II.	35	III.	12		12
1.	2	1.	10	1.	7		
2.	3	2.	4	2.	0		
3.	3	3.	4	3.	2		
4.	3	4.	3	4.	3		
5.	3	5.	3	5.	0		
6.	2	6.	3	6.	0		
7.	2	7.	3		—		
8.	2	8.	3				
9.	2	9.	1				
10.	2	10.	1				
11.	2	11.	0				
12.	2		—				
13.	1		35				
	29						

Total: 29 + 35 + 12 = 76 corresponds satisfactorily with original estimate.

WHAT OTHERS ARE DOING

Hadley Auto Department

A. B. Jordan

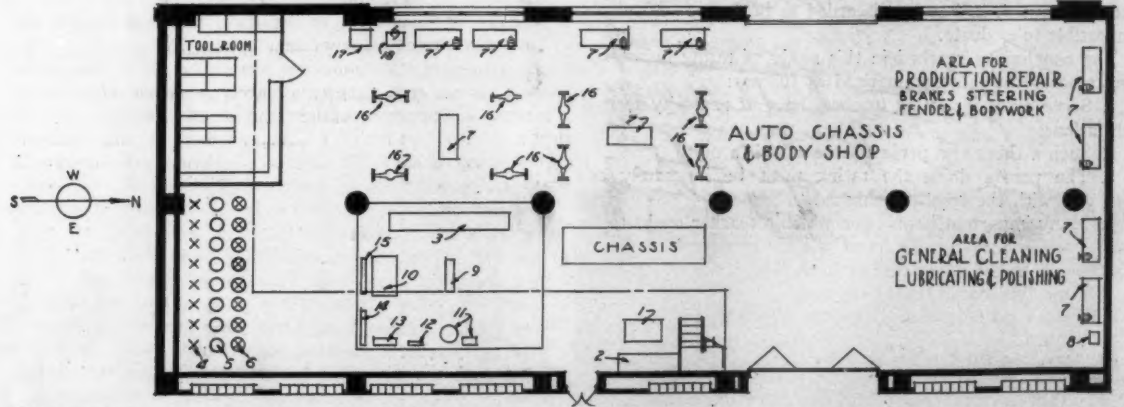
Hadley Vocational School,
St. Louis, Missouri

A description of the auto department in the well-known Hadley Vocational School, together with the layouts of the different auto shops and the course outline used in teaching this trade subject, will be of interest to both vocational and industrial-arts men.

IN 1928, the St. Louis board of education made plans to house the various vocational-training activities in a single building, and in November, 1931, the various training programs, grown to large proportions in unused rooms in several schools, were housed under a single roof. The building is of the "U" type, covering one city block. It is a five-story building, of reinforced concrete, faced with brick. The roof is used for recreational purposes. One wing of the building has the interior walls plastered. The adjoining two wings are lined with brick painted white, and have 15-foot ceilings, which is a 3-foot greater height of ceiling than will be found in the single wing. The purpose of this height of ceiling is to provide accommodations for shops that need this added clearance for the equipment or type of work done in them. The entire structure represents a shell with no permanent partitions for room size other than corridor partitions, leaving room space on each side. This entire shell is then subdivided into rooms of varying sizes by metal partitions which can and have already been moved to permit the enlargement of some departments and the reduction in size of others. As changing conditions make necessary the altering of facilities for any particular training program, the changes can be made quickly and inexpensively. In the shop section, each 20-foot floor space has five electric floor outlets, suitably spaced to accommodate new machines as they become necessary.

No general assembly hall is as yet provided. The present building is one unit of the contemplated plant, while the other unit, when built, will provide general office space, auditorium, and additional classrooms, with one of the wings constructed to lend itself to the presentation of technical-high-school subjects. The largest room in the present building is

Fig. 1. The balcony in the auto shop



1. Teacher's desk
2. Books and instruction-sheet case
3. Metal storage rack
4. Transmission storage
5. Steering-gear storage
6. Differential and brake assembly storage
7. Workbench
8. Gas furnace
9. Hydraulic press
10. Cleaning tank
11. Welding outfit
12. Anvil
13. Lever shears
14. Spring storage rack (heavy duty)
15. Clutch and drive shaft
16. Rear axles on stands
17. Drill press
18. Grinder and bufffer (heavy duty)

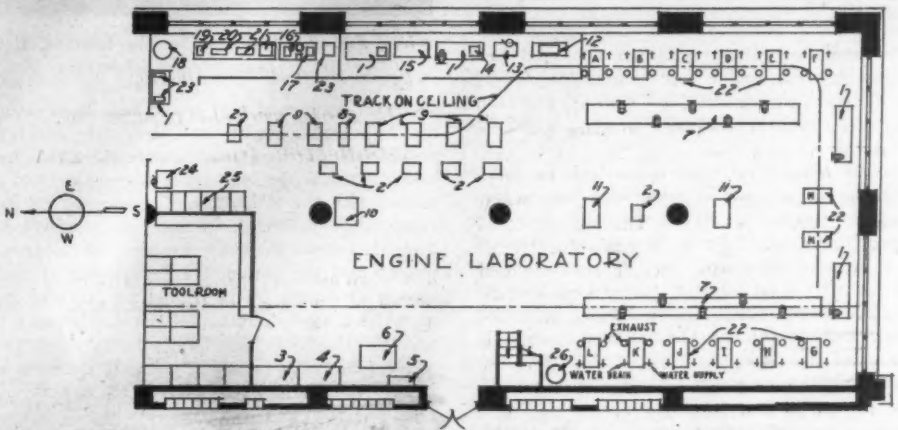
the school cafeteria, which seats 1,100 students. The entire school can be addressed through a permanent public-address system from the central office. The public-address system is sufficiently flexible to permit connecting individual rooms or departments to the central office or to sources outside of the school. Nearly the whole of the upper two floors of the building are used for training in commercial work and for the school cafeteria; while the lower three floors are adapted to industrial-training shops and the accompanying related technical classwork and academic social subjects.

One freight elevator and two high-speed passenger elevators are used for interfloor transportation.

Floor Plan of Automotive Department

The automotive department is housed in four individual shops, with a total floor space of 13,000 square feet. The shops are: (1) chassis and body shop, 4,000 square feet; (2) engine laboratory, 3,200 square feet; (3) ignition — lighting and starting laboratory, 1,400 square feet; (4) garage service

Fig. 2.- First-term laboratory shop work in chassis and body shop



1. Workbenches
2. Tool and parts tray
3. Parts storage case
4. Catalog and service manual case
5. Instruction-sheet file
6. Teacher's desk
7. Metal - topped benches and parts storage bins
8. Boring bar and cylinder grinder
9. Dead engines
10. Electric test bench
11. Sectionalized demonstration engines
12. Six-inch lathe
13. Valve-face grinder
14. High-speed drill stand
15. Cleaning tank
16. Reamer drive
17. Pin-hole hone
18. Babbit furnace
19. Babbit jig
20. Rod boring tool
21. Rod aligning fixture
22. Live Engines:
23. Arbor press
24. Grinder
25. Oil storage tanks
26. Oil filter

A. 4-cylinder "L" pressure lubrication
B. 4-cylinder Ford, splash lubrication
C. 4-cylinder "F" head, splash lubrication
D. 6-cylinder "T" head, splash lubrication
E. 6-cylinder "L" head, pressure lubrication
F. 6-cylinder "L" head, automobile clutch and free-wheeling
G. Straight-eight "T" head
H. 4-cylinder sleeve valve
I. 90-deg. V-8 "L" head
J. 60-deg. V-8 "L" head
K. 65-deg. V-8 "O.H." camshaft
L. 60-deg. V12 "L" head
M. 90-deg. V-8 Hisso
N. 45-deg. V-12 Liberty

Fig. 4. Engine laboratory

shop, 4,400 square feet. Each one of these shops is connected to a ventilating system and each one has a suspended steel balcony (see Fig. 1), midway between the floor and ceiling and extending 9 feet from the corridor wall. The balconies afford sufficient additional floor space for certain types of work and storage racks, and are equipped with washing facilities and wall-type lockers for shop clothing. Changing to work clothes by the student, washing up, and changing to street clothes, is all done on the balconies in each respective shop thereby making it unnecessary to leave the working quarters.

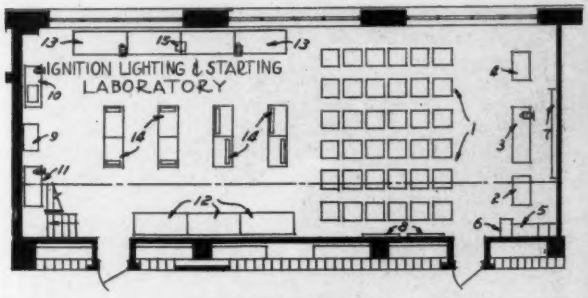
The chassis and body shop is the only one of the four which does not have the advantage of outside light.

When the steering gears, transmission, differential and brake assemblies are removed from their storage places to be worked on as laboratory shop equipment, they are so constructed as to fit in sockets in the center of each workbench, which holds the piece of equipment upright and securely so that the student can work on it. This equipment can then be returned to its storage place at the end of the period, and be got out again at the beginning of the next shop period.

The differential hoists run on the overhead track and can transport engines or heavy objects from the service shop to the engine laboratory, as well as lifting cars in the service shop, and engines and heavy equipment in the laboratory.

The live engines are connected to a built-in exhaust manifold with mufflers, which are connected to a ventilating blower, which in turn forces the exhaust through a stack on top of the building. City water pressure is manifolded by flexible connection to the engine. Waste water is emptied into a sewer connection; no radiators are used.

The nature of the work of the ignition, starting, and lighting laboratory makes necessary the use of assembling the



1. Student desks
2. Teacher's desk
3. Demonstration benches with storage drawers
4. Parts table
5. Bookcase
6. Instruction-sheet file
7. Blackboard and projector screen
8. Bulletin boards
9. Tool cabinet
10. Bench lathe
11. Generator and starter assembly
12. Electrical experiments bench
13. Generator and starter systems (laboratory)
14. Circuit wiring panels
15. Growler

Fig. 3. Classroom in the ignition, lighting, and starting laboratory

class in its seats for the presentation of such fundamentals that need to be presented. These seats are also used as a classroom for teaching our engine and running-gear theory. The laboratory electrical experiments, and ignition, generator, and starter units are stored in numbered drawers, directly in the benches.

Since only production service work is done in the garage service shop, the layout and use of equipment can be compared to that of any commercial service shop, and is used in the same manner that it would be in the commercial world. It is possible to drive automobiles into this shop from the outside and on through the service shop, across a corridor into the chassis and body shop, which has no outside connection.

Development of the Department

In development of the department, every effort was made to avoid as many mistakes or errors in judgment as possible. For this reason, the final recommendation to the board of education's building and supply departments for the purchase of equipment was placed in the hands of a committee, the personnel consisting of:

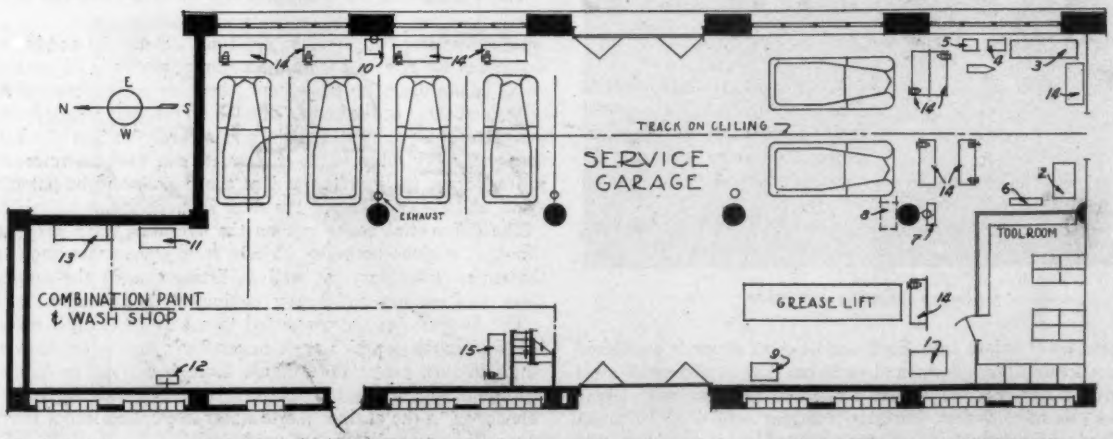
1. Secretary to all dealers in new cars.
2. President of a large automobile sales and service company.
3. The service manager of another large firm.
4. The sales manager of still another large firm.
5. The owner and operator of an independent garage.
6. The shop foreman of a smaller car sales and service firm.
7. The administrator in charge of vocational education.
8. An instructor in the automotive department.

Recommendations made for the purchase of all major equipment and tools had to be justified by the member making the recommendation to the balance of the committee. This procedure prevented, first, the purchase of some unnecessary equipment that would have been extremely difficult for the school to justify at a later date, and second, it made possible the purchase of some equipment that would not have been authorized by the school authorities, had the men connected with the school alone, attempted to justify it. This co-operative procedure immediately established a feeling of common interest between "keymen" of the trade in the community and the automotive department of the school. This co-operative work of the committee provided the groundwork on which a most desirable relationship between the tradesmen and the school has been built.

The experience of three years of teaching in these shops has convinced the writer that if the expenditures for equipment could be budgeted over a period of three or four years so that the purchase of the equipment could be co-ordinated with the development of the courses of study, then equipment better suited to the demands of the course could be secured, than if all the equipment were purchased before the details of the training program had been developed.

The Auto-Mechanics Course

The first year and a half spent by the 14-year-old eighth-grade graduate at the vocational school, is given over to a program of studies that will give him some background of fundamental trade skills, and knowledges. These experiences lie in the fields of: (1) building trades, (2) woodwork, (3) wood finishing, (4) blue-print reading and sketching, (5) bench metal, (6) electrical repair, (7) operation of machine-shop equipment, (8) sheet metal.



1. Teacher's desk
2. Record clerk's desk
3. Heavy-duty lathe
4. Drill press
5. Brake-relining machine
6. Press
7. Tool grinder
8. Valve-face grinder
9. Air station
10. Cleaning tank
11. Paint storage cabinets
12. Air transformer
13. Air compressor on balcony
14. Workbenches
15. Engine tune-up and testing bench

After completing this training, the student is about 16 years old, and is better informed so that he can choose more intelligently the training program which he will follow if he continues in school.

The training course for auto mechanics at the Hadley Vocational School is as follows:

AUTO MECHANICS

Grade X

Term II

	P.P.W.*
Auto mechanics I (Chassis and Body Work)	20
Running-Gear Theory I	5
Shop Records and Accounting I	5
Trade Mathematics IV	2½
English IV	5
Study or Library	2½

Grade XI

Term I	P.P.W.	*Term II*	P.P.W.
Auto mechanics II (Engine Work I)	20	Auto mechanics III (Engine Work II)	20
Ignition — Lighting and Starting I	7½	Ignition — Lighting and Starting II	7½
Engine Theory I	5	Engine Theory II	5
Industrial History I	5	Industrial History II	5
Study or Library	2½	Study or Library	2½

Grade XII

Term I	P.P.W.	*Term II*	P.P.W.
Auto mechanics IV (Garage I)	15	Auto mechanics V (Garage I)	15
Applied Science I or Drafting I	10	Applied Science II or Drafting II	10
English V	5	English VI	5
Economics I	5	Economics II	5
Study or Library	5	Study or Library	5

Fig. 5. Record desk and toolroom in service garage

Except the subjects of English, Economics, and Industrial History, the related technical subjects listed in the courses of study are intended to be developed around the shopwork of the student in as near a logical order as he will need this information in the shop, and as it is practical to do in classroom instruction.

In shopwork, wherever practical, instruction on any unit of the automobile, such as rear axle, transmission, etc., is given on that unit on a distinct and separate piece of shop equipment. We have learned in our shops to speak of this as laboratory equipment. The student does not progress to the stage of working on any part of an automobile until he has demonstrated to the satisfaction of the instructor that he has sufficient knowledge of the construction and adjustment of that particular unit. From this point on, working on the car is encouraged. We have grown to speak of such work on different customers' cars as production work. A nominal charge is made by the department for any service rendered. The details of these charges will be brought out more clearly in the discussion of the Service Garage, in which place production work of all types is welcomed and accepted as long as students are available that have demonstrated their ability to do this work on laboratory equipment. The only exception to this procedure being in the case of some fender and body work and lubrication service. The preliminary training in engine work and ignition work is organized around the laboratory instruction idea and the method of instruction and material used varies only because of the difference in the instructional content. Type jobs selected from the standards previously determined by tradesmen and built around shop laboratory equipment are listed for each shop activity on an individual form, kept for each student by the instructor. The student progresses through these type jobs as rapidly as his ability, application, and shop conditions permit. A specimen of one of these forms follows:

HADLEY VOCATIONAL SCHOOL ENGINE LABORATORY

(Instructor) Sheet One (Student)

Operations Required in Engine Work

No.		Engine	Date	Time	Instr. Approval
E-1	Start an engine: (1) crank, (2) starter				
E-2	Adjust fan belt				
E-3	Repack a water pump *: (1) wicking, (2) metal				
E-4	Drain oil pan and refill				
E-5	Remove, clean and replace oil pan*				
E-6	Clean oil-pump screen				
E-7	Remove and replace transmission				
E-8	Remove clutch, inspect, replace and adjust*				
E-9	Remove, inspect, replace and adjust automatic clutch-operating mechanism*				
E-10	Remove starter, inspect drive*: (1) bendix, (2) shifter				
E-11	Remove and replace carburetor (renew gasket)*				
E-12	Remove, clean and replace air filter				
E-13	Remove, clean, inspect and adjust spark plugs*				
E-14	Adjust valve clearance *--"L," "I," "V"				
E-15	Remove and replace timing gears*				
E-16	Remove and replace flywheel*				
E-15	*Remove and replace cylinder head*--"L," "I," "V"				

SPECIAL JOBS

No.		Date	Grade	Instr. Approval
1	Toolroom--(1) ass't. attendant (2) chief attendant			

* Call instructor for final check (engine running)

Each shop has what is customarily called a progress chart. In the automotive department this is used as a location chart, so as to determine whether the piece of equipment is in use by any student in the department, be he in a morning class, afternoon class, or an evening trade-extension class.

Fig. 6. Service garage

*Periods per week.

Individual instruction in the shop is used to the exclusion of practically all other methods. Demonstrations are made, before any student in the class is permitted to progress beyond certain jobs. By following this method, much less equipment of any particular unit is required, since some boys will begin shopwork on springs, while others will begin on rear axles, and still others on brakes. The type of instruction sheet that is used, follows:

SPECIMEN INSTRUCTION SHEET

Operation E–10 Marmon, 1928

REMOVE STARTER AND OVERHAUL DRIVE

1. Remove battery cable from starting motor.
2. Remove starting motor from flywheel housing by removing three 3/8" U.S.S. cap screws.
3. Remove two 1/4" U. S. bolts holding the starter-drive housing together and remove drive.
4. Clean and inspect drive and look for damaged parts. Call instructor.
5. Test starter torque, see Allen Test Manual.
6. Replace in the reverse order in which it was taken off.
7. Test with battery. Crankshaft must turn over.
8. Secure Instructor's O.K.

Tools	*Materials*
End wrenches	Rag
Screw driver	Gasoline
Pliers	

QUESTIONS

1. What causes the starter gear to engage with the flywheel?
2. When does the starting motor begin to turn?
3. Is there any provision made to absorb the shock caused when the starter gear engages with the flywheel gear?
4. Is there any provision made to avoid damage, when the flywheel or starter gear should fail to engage?

REFERENCES

1. *Marmon Manual* (1928), 36 pages.
2. Kuhns, *Automotive Service*, 920 pages.
3. Roenigk, *Electrical Maintenance*, 80 pages.
4. Dyke's *Encyclopedia*, 16th Edition, 323 pages.

These instruction sheets are almost self-explanatory. They were written:

1. In a style to keep them on the reading level of an eighth-grade graduate, the only exception being that the necessary technical terms have been added.

2. With the idea that the student must read the full instruction sheet before beginning work on the job.

3. With the purpose of having the student prepare himself to answer questions at the end of the sheet by referring to the reference material kept on hand in the shop.

4. With the idea of establishing definite checking levels and that the student be not permitted to progress beyond the point where the instruction sheet directs him *to call the instructor*.

Generally the instructor writes these sheets. If not, he must be sufficiently well acquainted with them, that at the point, "Call instructor," he can make a check-up on the work and give the necessary additional instruction or demonstration. The student or the instructor can also at this point best answer the questions at the end of the sheet. It is well, also, at this point to teach the student the need and possibility of explaining things to the customer. The continual cry which the auto department receives from men in the trade is: *"We have many well-trained men, and can hire others, but they cannot merchandise themselves, their services, or necessary repairs and replacements which the customer's car may need."*

Service Garage

It is well to remember that a student coming into the automotive department might be found working in our service garage several weeks after he has entered the department through the chassis and body shop, but the work that he is permitted to do will be that work which he has already demonstrated his ability in, to the satisfaction of the instructor; and at the completion of this job will return for further instruction to a shop of original entrance. When the advanced student is assigned to the service garage for his shopwork, the tradesman in charge of the garage is already familiar with the student's ability and the student is acquainted with the procedure to be followed with production work, the need for thorough inspection, and the absolute necessity of testing. When the student has arrived at this stage he has already gained some fundamental knowledge and has acquired some skill in doing a definite piece of work, but further instruction is often necessary. This, whenever practical to do so, is done in the garage, but if it is apparent that the student is too weak to continue further with the job, he is replaced by another and returns to whatever shop necessary, to receive more instruction on doing that particular job.

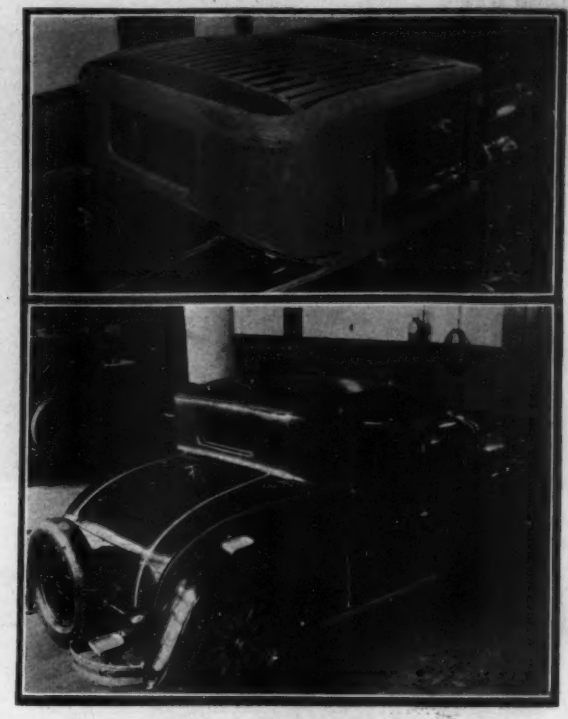


Fig. 7. Repairing and painting in the chassis and body shop

All work that is taken is accepted with the understanding:

1. That the school shop agrees to do satisfactory repairwork.
2. That the owner of the car agrees to leave it in the shop until the job has been completed satisfactorily.
3. That the automotive department will purchase all parts that are used in the repair of the automobile and that the customer will be charged for them at standard retail prices.

By adhering strictly to these three points, a rather enviable reputation has been gained by the department for its production work on automobiles, with a minimum of dissatisfied owners.

The ordering of parts and the necessary accompanying forms, telephone conversations, cash transactions, and entries in the customer's account are made entirely by the advanced students of the automotive department, as a part of their training in shop records. They are supervised, of course, by the head of the department. By adhering strictly to these regulations, the good will of the "parts jobber," the repair shops, and the mechanics working in them has been gained. A very free understanding exists between the automotive department of the school and the trade, on the question of production service work providing training for the advanced students who, when leaving school, will enter the trade as advanced apprentices.

(Continued on page 14A)

Schools Favor "Oliver"

The approval and purchase of "Oliver" Woodworking Machinery by more than 2,000 school shops, is an outstanding recognition of "Oliver" high standards of safety, utility, durability—in short, their inbuilt Quality.

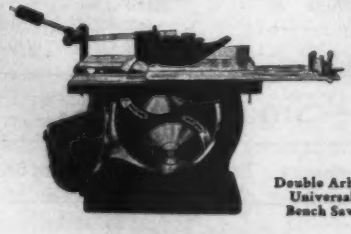
24-in. Single Surface Planer

Double Arbor, Motor Arbor, Tilting Saw Bench

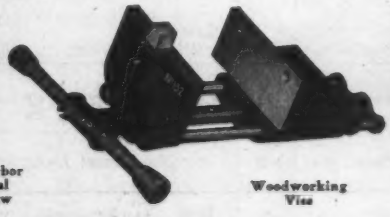
6-inch Hand Planer and Jointer

Hollow Chisel Mortiser

Disk Sander



Double Arbor Universal Bench Saw



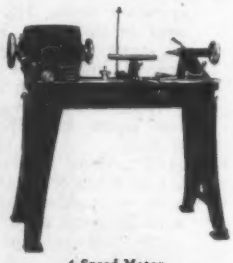
Woodworking Vise

These important features responsible for "Oliver" Leadership are prominent factors in the progress and development of the woodworking departments in school shops — a development with which "Oliver" has been closely identified from the very beginning of Industrial Arts and Vocational Education. Years of satisfactory service in the woodworking industry preceding school shop acceptance and use has given "Oliver" a background of experience in providing the school shop requirements.

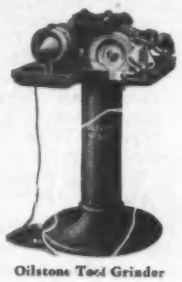
The illustrations on this page are typical of the complete line of woodworking machinery now available for school shops. Besides the machinery and tools illustrated, the "Oliver" line comprises such products as Saw Blades — Boring Bits — Glue Pots — Jig Saws — Forges — Vises — Belt Sanders, etc.

Special attention is given to School Shop Executives and inquiries and correspondence relative to requirements are solicited.

Oliver Machinery Company
Grand Rapids, Michigan, U.S.A.

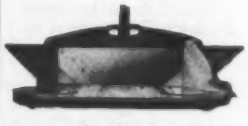


4-Speed Motor Head Lathe



Oilstone Tool Grinder

Electric Band Saw Brazer



Wood Trimmer

30-inch Band Saw

Woodworking Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.
Benches	
Hardwood tops, 1¾ in. or over in thickness, built up of strips with tongue-and-groove joints, the top to project far enough to allow a rapid-acting or continuous screw vise to be attached.	
It is a good idea to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type	
Glue	
Stain, with metal-covered top	
Teacher's Demonstration....	
Blackboard	
Permanent or portable	
Bookcase	
For reference books, catalogs, etc.	
Bulletin Board	
Cabinets, wood or metal for filing class records, instruction sheets, drawings, etc....	
Chairs	
Tablet-arm chairs	
Core Oven (for patternmaking class only)	
Desk	
Teacher's, with drawer compartments	
Chair, to match desk..... ..	
Furnace, for melting soft metals (for patternmaking class only)	
Glue Pot, 1-qt., or 2-qt. size, electric, gas, or steam heat..	
Glue Warmer or Cooker	
1 to 5 gal. capacity.....	
Grinder	
Automatic knife, direct motor-drive type. Size to suit largest knife used in the school shop. Grinder to be complete with water pump, grinding wheel, and automatic stops	
Bench, hand or power.....	
Bench, motor-in-head. Motor bearings to be completely housed. Wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel	
Revolving oilstone, pedestal type, with one fine and one coarse oilstone	
Jointer	
6- or 8-in. portable jointer. Table to be fitted for rabbeting. Safety-cylinder type, and equipped with safety guard	
12-, 16-, or 18-in. direct motor-drive, ball-bearing. Cylinder to be of safety-head type. Table to be fitted for rabbeting. Jointer to be equipped with safety guard	
Lantern	
Stereopticon-view machine for opaque objects and standard-type lantern slides	
Lathes	
6- to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block...	
Patternmakers, with end faceplate provision. Lathe to be of direct motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class only).	
Mortiser	
Direct motor, or belt driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod.....	
Portable, vertical, hollow-chisel mortiser, bench type	
Planer	
12-, 18-, 20-, 24-, or 30-in. motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife setting and jointing device complete with bar should be mounted on machine if possible	
Saws	
Band Saw, 20- to 36-in. motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.	
Combination, band saw, crosscut saw, rip-saw, and mortiser. Machine to be completely guarded	
Cut-off, pedestal or swing type to be fitted with 12- to 16-in. saw	
Filing machine, direct motor-drive	
Jig, direct motor or belt-driven	
Portable band saw, 16 to 20-in. ball-bearing, motor driven	
Saw bench, direct connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided	
Universal saw bench, 14 to 16-in., motor driven	
Variety saw bench, motor-driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cut-off gauges	
Sander	
Belt, direct motor-drive.....	
Disk, motor or belt driven...	
Oscillating-spindle, motor driven	
Portable, hand-plane type. Direct motor-drive	
Vertical-spindle and disk sander	
Shaper	
Motor-drive, single or double spindle. Table to be equipped with removable center plate.....	
Portable shaper or router with a suitable selection of cutters	
Tenoner	
Single end, with coping heads and cut-off saw	
Vises, rapid-acting or solid-nut type woodworking bench vises, 7 to 10-in. face.....	
Wood Trimmers, complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings. (For patternmaking class only).....	

Woodworking—Small Tools

Name and Description	No.
Awls, Brad, assorted sizes.....	
Bevels	
Protractor	
Sliding T, 8"	
Bits	
Auger, 1/4" to 1" inclusive by 16ths, each	
Auger, 1/4" to 1/2" inclusive by 16ths, each	
Braces, ratchet type, 8", 10", 12" or 14" sweep.....	
Countersink, for wood, rose	

(Continued on page 10A)

Stanley Electric Tool Division

THE STANLEY WORKS

Educational Department, New Britain, Conn.

Manufacturers of

Stanley Portable Electric Tools

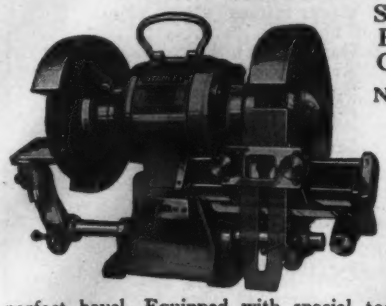
Stanley Electric Tools are made to the same careful standards as Stanley Hand Tools which for 80 years have maintained an enviable reputation for high quality. Send for Catalogue No. 59 showing the complete line.

STANLEY

Stanley Router-Shaper — new, economical, woodworking equipment for the school shop made similar to that used in large furniture factories. A single power unit can be used in a group of fixtures to make several versatile machines. Send for Catalog No. 61.

Stanley Electric Plane Iron and Chisel Grinder

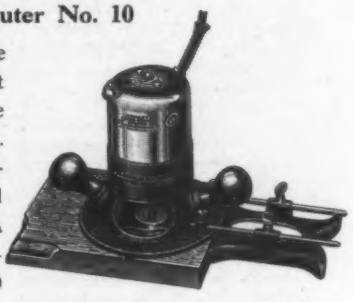
No. 567—7" Wheels



Designed for the woodworking shop. A grinding attachment holds all sizes of plane irons and chisels so that any boy can grind a perfect bevel. Equipped with special tool grinding wheels. Ball bearing motor operates at slow speed of 1725 R.P.M. Equipped with Safety wheel guards. If desired can be furnished with safety glass eye shields.

For A.C. 110 volts and D.C. 115 volts.

Stanley Hand Router No. 10



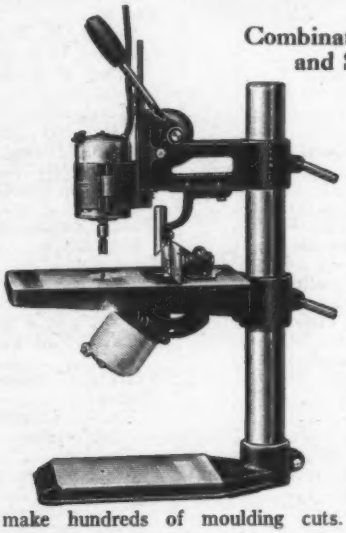
A compact machine easily handled so that free hand cuts can be made to a knife line. Ideal for carving, inlaying, veining, panel work dadoing, etc. A compact ⅜ H.P. universal motor for 110 volts constitutes the power unit. It is equipped with heavy duty ball bearings and runs at 18,000 R.P.M.

Stanley Portable Electric Drills

Pipe handle and pipe handle casting are removable, permitting Drills to be used in small spaces.

No. 121—½" Standard Duty. A popular drill for the machine, electrical and automotive shop. Capacity ½" in steel, 1⅜" in wood. Full load speed 275 R.P.M.
No. 582—⅝" Heavy Duty for heavy drilling in the automotive and machine shop. Capacity ⅝" in steel, 1⅝" in wood. Full load speed 250 R.P.M. Voltages 110, 150, 220 or 250 as specified.

Stanley Combination Bench Router and Shaper No. 30



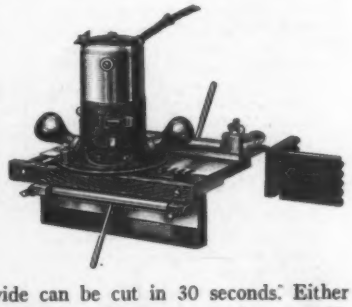
Uses the same power unit for all kinds of bench routing, mortising, flat turning, etc. By using simple templets intricate designs can be easily duplicated on wood. Illustration also indicates how the motor can be transferred to the holder under the table and used as a shaper. This holder can be tilted 45° so that it requires but 3 or 4 cutters in various combinations to make hundreds of moulding cuts. Other uses — tongue, groove, core, chamfer, rabbet and many, many other cuts.

Stanley "Mighty Midget" Unishear

A motor driven shears

Cuts up to 18 gauge iron, 16 gauge aluminum, etc., also leather, fibre, cardboard, etc., up to 15 feet per minute. Weighs only 6½ lbs. and is easier to handle than a pair of snips. 100% safe. Cuts straight lines, curves, angles, and notches with hair-line accuracy. Universal motor. Voltages 110, 150, 220, or 250 as specified.

Stanley Dovetail Fixture No. 60



Now your boys can make perfect dovetails easily and quickly. In cutting an open dovetail, as illustrated, both pieces are cut at the same time assuring absolute accuracy. A dovetail piece 6" wide can be cut in 30 seconds. Either blind or open dovetails can be made in any wood up to ¾".

Send for Catalogues

"Stanley Equipment is Standard Equipment"

Stanley Electric Tool Division, Educational Dept., 106 Elm Street, New Britain, Conn.

(Continued from page 8A)

Name and Description	No.	Name and Description	No.	Name and Description	No.
pattern, ½" and 5/8", each		**First-Aid Cabinet and Supplies**		Band, ¼", ½", ¾", to fit power machine, each	
Dowel, square shank, ¼", 5/16", ⅜", ½", ¾", each		**Floor Brushes**		Compass, 10"	
Expansive, ⅞" to 1½"		**Gauges**		Coping, frames	
Expansive, ⅞" to 3"		Bit, adjustable		Coping, blades	
Forstner, square shank, ¼" to ½" inclusive, by 16ths, each		Jointer		Crosscut, 9-tooth, 22" long	
Screw Driver, square shank, ¼", 5/16", ⅜", each		Marking, metal or hardwood		Crosscut, circular for power machine	
Twist Drill for wood, square shank, 5/16" to ⅜" inclusive by 16ths		Mortise, metal or hardwood		Dado, ⅛" to 1 1/16" to fit power-saw arbor	
Twist Drill, straight shank, 5/16" to ⅜", inclusive by 32nds, each		Panel		Hack, frames, 8" or adjustable	
Blowtorch		**Glass Cutter**		Hack, blades, 8"	
Brooms		**Gouges**		Keyhole, 10", 10 point	
Brushes		Tanged firmer, outside ground, handled, ⅛", ¼", ½", ¾", 1", each		Rip, 7 point, 22" long	
Bench Duster, 10"		Tanged-firmer, inside ground, handled, ⅛", ¼", ½", ¾", 1", each		Rip, circular for power machine	
Glue, round, ½" and ¾", each		Spoon, ½", ¾", and 1", each		Set, 10 points per inch and finer	
Glue, round, 1½"		**Hammers**		Set, 10 points per inch and coarser	
Marking, camel's hair, No. 1 and No. 2, each		Claw, bell-faced, 10 oz.		Turning frame, 14"	
Varnish, flowing, 2"		Claw, bell-faced, 12 oz.		Turning blades, 5/16"x12", 10 tooth	
Varnish, flowing, 2½"		Claw, bell-faced, 13 oz.		Miter-box, 24"x4" saw, 7" capacity at miter	
Varnish, flat, ½"		Claw, bell-faced, 16 oz.		**Scrapers**	
Varnish, flat, ¾"		**Hand Screws**		Cabinet	
Varnish, flat, 1"		Adjustable, length of jaws, 4", 5", and 6", each		Glue, triangular	
Burnishers, oval or round		Adjustable, length of jaws, 7", and 8", each		Veneer, blade 2¾" long, handle 11" long	
Calipers		Adjustable, length of jaws, 10", 12", and 14", each		**Screw Drivers**	
6", outside		**Hatchet**, Bench, 4" cut		Cabinetmakers', 4", 6", and 8" each	
6", inside		**Jars**, Earthenware, 1-qt. capacity		Quick-return, spiral ratchet	
12", outside		**Knives**		**Shoot Board**, and plane	
12", inside		Jointer, to fit power machine		**Snips**, Tinners', forged steel, 2½" cut	
Can Opener		Planer, to fit power machine		**Spokeshaves**, adjustable, raised handle, 10" long	
Carving Tools		Sloyd, 3" blade		**Squares**	
Sets containing 6 tools		**Levels**		Combination, 12"	
Sets containing 12 tools		Wood, 24"		Try-, iron handle, 8"	
Chisels		Machinists', 12"		Framing, 2'	
Cold, machinists', ⅜" and ½", each		**Mallets**, Hickory, 3" by 5" head		**Steel Figures**, hand cut, ⅛", sets	
Mortising Chisel and Bits, ¼" to 5/8" by 16ths, each		**Nail Sets**, Point, 5/16" and 7/16", each		**Tapeline**, 50' steel	
Socket-firmer, bevel edge, ½", 1", and 1¼", each		**Oilers**, Bench, ⅓ pt. coppered, best grade		**Trammel Points**, Adjustable metal frame, steel points	
Socket-firmer, bevel edge, ¼", ½", and ¾", each		**Oilstones**		**Turning Tools** (For 12 lathes)	
Socket-firmer, plain edge, ½", ¾", and 1", each		1"x2"x8" in iron box		Calipers, 6" inside and outside, 12 each	
Tanged-firmer, bevel edge, ⅛", ¼", ½", ¾", 1", and 1¼", each		Gouge Slip, medium, 4½"x2⅛"x5/8"x7/16"		Calipers, 12" inside and outside, 1 each	
Clamps		Gouge Slip, fine, 3"x2"x⅜"x⅛"		Parting Tools, ⅛"	
Screw, adjustable, 24", 36", and 48", each		**Pincers**, 6" carpenters'		Round point, ¼", ½", ¾", each	
Screw, adjustable, 60"		**Planes**		Spear point, ¼", ½", ¾", each	
Tilting Saw		Block, adjustable, 6" long, 1⅝" cutter		Square point, ¼", ½", ¾", each	
Dividers, Wing, 6" and 10", each		Circular		Turning Chisels, ¼", ½", ¾", each	
Doweling Jigs, with bushings		Combination, adjustable		Turning Gouges, ¼", ½", ¾", each	
Dowel Plate, 6" long		Core Box		Turning Skews, L.H. ¼", ½", ¾", each	
Drawknives, 7"		Duplex, fillister and rabbet		Turning Skews, R.H. ¼", ½", each	
Drill		Fore, 18", 2⅜" cutter		**Vise**, 3" jaw, anvil face	
Automatic Hand, with 8 drill points		Irons, double		**Wrenches**	
Chuck, 0 to ⅜"		Jack, 14", 2" cutter		Adjustable, 8", 10", and 12", each	
Hand, 0 to ⅜", for round-shank drills		Jointer, 24"		Headless Setscrew, ¼" to 5/8" by 16ths, 1 each	
Star, for concrete, ½" and ¾", each		Round, wood, 1¾"		Pipe, 10" and 12", each	
Files		Router		S-type or open-end type to fit ¼" to 1" U.S.S. nuts, each	
Auger Bit, assorted 6"		Smooth, 9", 1¾", or 2" cutter			
Cabinet, 8" and 10", each		**Pinch Dogs**, ¾", 1", and 1¾" each			
Card and Brush		**Pliers**			
Flat, wood 10"		Round-nose, 5"			
Mill, bastard cut, 10"		Side-cutting, 6"			
Round, bastard cut, 12"		**Putty Knives**			
Taper, slim, 5½" and 7", each		**Rasps**, half-round, wood, 10"			
		Rules			
		Board			
		1' or 2' graduated by 8ths and 16ths			
		Shrink, ⅛", 7/16", each			
		Saws			
		Back, 12", 14 point			

(Continued on page 12A)

Huther Bros. Saw Mfg. Co.

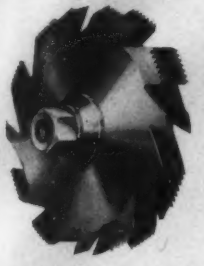
1290 University Ave., Rochester, N. Y.

Manufacturers of

Circular Saws, Groovers, Band Saws

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type of workmanship and is backed by a guarantee to be as free from flaws and seams as possible. Complete catalog on request.

Dado Head



Our dado head developed from our own patents cuts grooves with or across grain, smooth, sharp sides, grooves from ⅛" up to 4" and over. Easily adjustable. Consists of 2 outside Cutters ⅛" thick and inside cutters to make desired cut. Inside cutters in 1/16", ⅛" and ¼" thicknesses. These Groovers make a perfect cut and leave the bottom smooth.

Angular Hub Groover

(New Patent No. 1782507)

This Groover was designed to cut end grooves in hard wood and to clear itself easily without swage or set. Clearance is effected by angular grinding of hub. Light adjustment. Used on regular saw mandrel without extra collars.

High Speed Knives

Shaper Stock, Ground Flat Stock

We manufacture thin High Speed Steel Knives, Solid Moulder Knives from High Speed Steel or Special Laid Steel. We can also furnish ground stock in various thicknesses and widths, square edges, in High Speed or best quality Tool Steel.

Band Saws

We make both wood and metal cutting band saws, also special temper saws for fibre, bakelite and soft metals. Let us know what you cut and we can furnish a saw for the purpose.

Inserted Tooth Groover

This is the perfect Groover for end grain cuts in hard wood. Teeth are High Speed Steel, front to back clearance, and require grinding on top only. Cuts full width groove through life of teeth. Teeth can be replaced.

New Steady Rim Rip

Pat. Pending

This is an extra smooth cutting Rip Saw designed for smooth cutting at fast feed. This is the smoothest cutting Rip Saw we have and is capable of beautiful work.

Saw Vise

Setting Stake

These are useful articles for the filing room and were both developed for use in our own filing department. Vise is easily adjusted for various bevel filing and takes saws up to 18" diameter.

Cutter Heads for Saw Mandrel

Cutter Heads for use on saw table. These heads can be furnished with variety of knives and used for jointing and running light moulding on saw table. Made in 6" diameter, 2¼" wide. Can be counterbored if necessary.

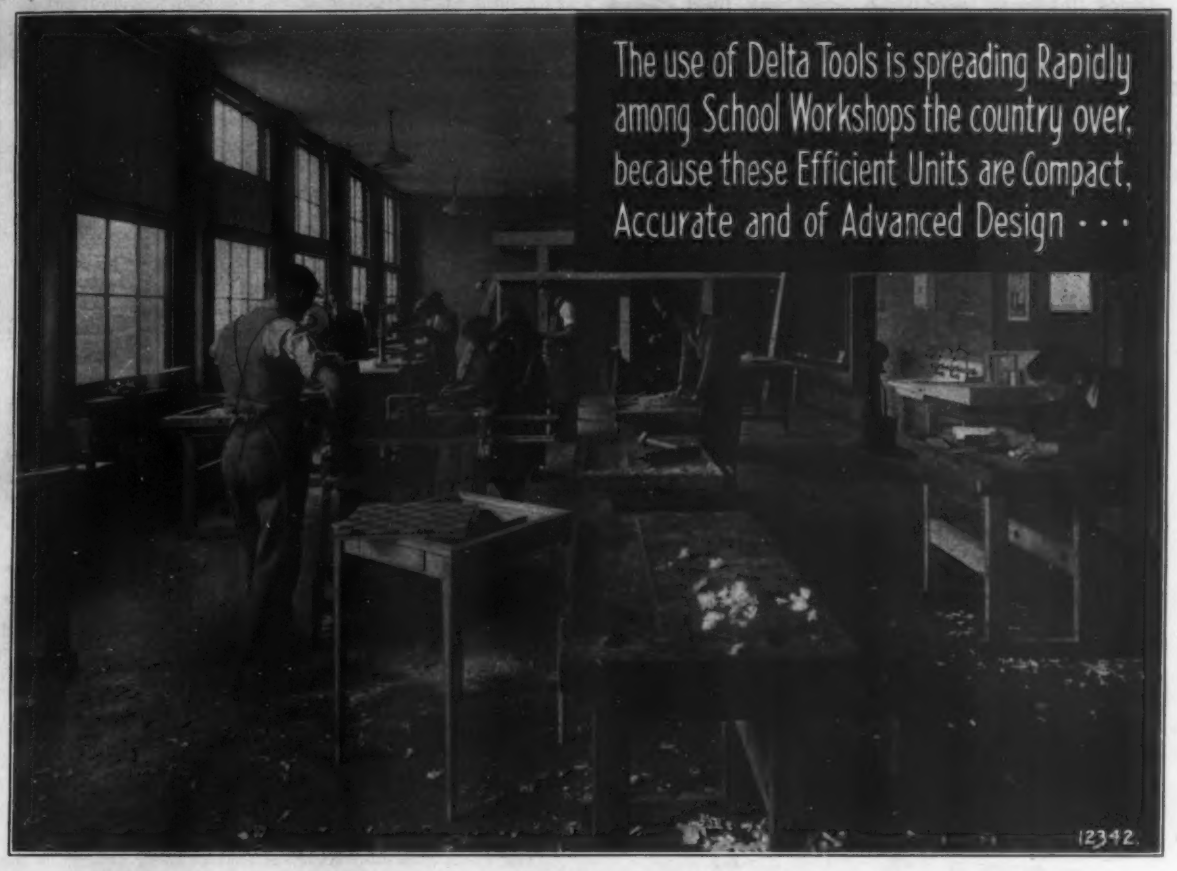
Mitre Saws

Our Mitre Saws are accurately ground with the proper side clearance and are made in six styles of tooth shape. Cleaner Tooth Saws are for both rip and cross-cut—made in diameters from 4" to 24".

(Continued from page 10A)

Woodworking—Materials and Supplies

Name and Description	No.	Name and Description	No.	Name and Description	No.
Alcohol, gallons		**Hooks**		**Screws**, gross	
Benzine, gallons		And Eyes		Flat-Head, brass	
Brads, pounds		Cup		⅜″ No. 3	
⅜″ No. 20		Screw		½″ No. 4	
½″ No. 20		Square Screw		⅝″ No. 5	
⅝″ No. 20		**Lacquer**, in 1-pt. cans		¾″ No. 5	
¾″ No. 19		Black		¾″ No. 6	
⅞″ No. 19		Clear		1″ No. 8	
1″ No. 18		Cobalt blue		1¼″ No. 10	
1¼″ No. 16		Ivory		1¼″ No. 12	
1½″ No. 16		Medium green		1½″ No. 10	
1¾″ No. 15		Red		1¾″ No. 12	
2″ No. 14		Thinner		2″ No. 10	
2½″ No. 14		White		Flat-Head, bright	
Carbon Paper, black, sheets		Yellow		½″ No. 3	
Colors, dry, 1-pound cans		**Lumber**		½″ No. 4	
Burnt sienna		The following woods are used in school shops: Ash; balsa; bass; birch; cherry; cypress; locust; mahogany; maple; oak; poplar; red cedar; red gum; redwood; sap gum; yellow pine; walnut; white pine.		¾″ No. 6	
Burnt umber				1″ No. 8	
Cobalt blue				1″ No. 10	
Chrome yellow				1¼″ No. 10	
Drop black				1¼″ No. 8	
Lamp black				1¼″ No. 14	
Prussian blue				1½″ No. 10	
Raw umber				1½″ No. 12	
Van Dyke brown				1¾″ No. 10	
Vermilion				1¾″ No. 12	
Colors, Ground, in oil or japan, 1-pound cans		In ordering pine, mill-run, kiln-dried will be found suitable for carpentry, while short select, kiln-dried 4″ and wider, or No. 1 shop common, kiln-dried will be required for cabinetmaking and pattern-making.		2″ No. 10	
Burnt sienna				2″ No. 12	
Burnt umber				2″ No. 14	
Cobalt blue				2¼″ No. 12	
Chrome yellow				2¼″ No. 14	
Drop black				2½″ No. 14	
Drop black, ground in japan		Hard wood, for furniture, should be specified first and second grade, kiln-dried, standard widths and lengths, or short lengths.		Oval-Head, brass	
Lamp black				¾″ No. 5	
Prussian blue				1¼″ No. 10	
Raw umber				Round-Head, blued	
Rose lake		**Moldings**		⅜″ No. 3	
Van Dyke brown		**Nails**, pounds		½″ No. 3	
Vermilion		Common, 6d		¾″ No. 5	
Decalcomania Transfers		Common, 8d		¾″ No. 6	
Dowels		Common, 10d		1″ No. 8	
¼″ hardwood, 3-ft. lengths, feet		Flat Head		1¼″ No. 10	
⅜″ hardwood, 3-ft. lengths, feet		½″ No. 20		1½″ No. 10	
⅜″ hardwood, 3-ft. lengths, feet		¾″ No. 19		1½″ No. 12	
½″ hardwood, 3-ft. lengths, feet		1″ No. 18		Round-Head, brass	
¾″ hardwood, 3-ft. lengths, feet		1¼″ No. 16		⅜″ No. 2	
Dowel Pins and Plates		1½″ No. 16		⅜″ No. 3	
Enamel		2″ No. 14		½″ No. 4	
White, 1-pt. cans		Finishing, 4d		⅝″ No. 3	
Undercoater, 1-pt. cans		Finishing, 6d		¾″ No. 5	
Fillers, Paste, pounds		Finishing, 8d		**Shellac**	
Natural		**Oil**, gallons		Orange, cut 4 pounds to the gallon, ½-gal. cans	
Golden Oak		Linseed, boiled		Sticks, assorted colors	
Dark Oak		Linseed, raw		White, cut 4 pounds to the gallon, ½-gal. cans	
Mahogany		Machine		Note: Shellac should be kept in glass or earthenware containers.	
Fillets, leather, ¼″ and ½″		Rubbing		**Stains**, Oil, spirit or water, quarts.	
Glue, hide, best grade cabinet, pounds		**Overlay Carvings**		Fumed Oak	
Liquid, 1-qt. cans		**Panel or Plywood**		Dark Oak	
Hardware		3 ply, 5 ply, 7 ply		Golden Oak	
Such as brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports.		**Pattern Letters**		Light Oak	
		Pins, Escutcheon		Mahogany	
		Pumice Stone, No. 0		Walnut	
		Rapping Plates		**Steel Wool**, 1-lb. packages	
		Rottenstone		No. 0	
		Sandpaper, reams		No. 00	
		Garnet, No. 1		**Turpentine**, gallons	
		Garnet, No. ½		**Twine**, balls	
		Garnet, No. 0		**Varnish**, ½-gal. cans	
		Garnet, No. 2/0		Flat	
		Garnet, No. 3/0		Remover	
		Garnet, No. 4/0		Rubbing	
		Garnet, No. 6/0, wet or dry finishing		**Waste**, pounds	
		Garnet paper can also be obtained in rolls of 50 yd. each, and in widths 3″ and up.		Cotton, white	
		Screw Eyes		**Wax**, pounds	
		Screw Hooks		Bees	
				Finishing	
				White Lead, pounds	


The use of Delta Tools is spreading Rapidly among School Workshops the country over, because these Efficient Units are Compact, Accurate and of Advanced Design · · ·
12342.

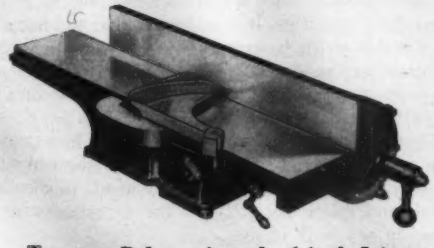
"DELTA" TOOLS IDEAL FOR SCHOOL SHOPS

The installation of Delta Quality Tools shown above is in the general laboratory of the Brentwood High School at Pittsburgh, Pa. This is but another of the installations of Delta tools in school woodworking shops. More and more instructors and supervisors are realizing that Delta tools offer much more than mere economy. They are compact, convenient, accurate, well-designed, and sturdily constructed throughout to stand up under years of hard usage.

When you examine Delta tools, point for point, inside and out, you find thoughtful engineering, no skimping in quality or design, and many remarkable exclusive patented features not found on heavier, more expensive machines. Especial care has been taken to provide adequate and practical guards—not flimsy makeshifts. (All Delta guards are approved by the Wisconsin Industrial Commission, whose requirements are very strict.) The Delta Company will gladly furnish vocational education supervisors and instructors with a complete catalog of the new 1935 Delta line.

Write today Dept. E 235

2 New 1935 Delta Tools



Two new Delta units—the 6-inch Jointer and the improved "De Luxe" Scroll Saw will be of unusual interest to all connected with school workshops. These two tools and their many special features, as well as other new tools and improvements, are described fully and in detail in the 1935 Delta Catalog.

DELTA MFG. CO.

3775 No. Holton St., Milwaukee, Wis.

ATKINS

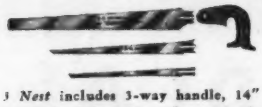
SILVER STEEL SAWS

No. 401 Skip Point—the best hand saw made. SILVER STEEL. Taper ground. Straight back. (No. 400 is skew back) Skip point in 26" length only. Regular pattern in 24" and 26" lengths.

No. 65 Skip Point for general use. SILVER STEEL. Taper ground. Straight back. (No. 53 is skew back) Skip point in 26" length only. Regular pattern in 20", 22", 24" and 26" lengths.

No. 10 Hacksaw Frame has non-breakable, hard rubber handle. Takes 8" to 12" blades.

"Blue End" Blades of SILVER STEEL. No others as good for economical cutting. (Also AAA blades of Tungsten Alloy steel but regular quality.)



No. 3 Nest includes 3-way handle, 14" compass, 12" keyhole and 16" tempered metal blade, all interchangeable.

No. 37 Dual Ground circular for wood working shops. Makes glue joints direct from saw. 5" to 20" diameters for all standard machines.

"AAA" Saw Guards recommended for all woodworking and school shops by state inspectors. Takes lumber up to 3". Lumber cannot kick backwards.

ATKINS SILVER STEEL Files for every use. Round, square, half-round and flat in all classifications. Tough and long wearing.

"THE FINEST ON EARTH"

Ask for Atkins TEXT BOOK and SAW SENSE—they're free.

E. C. ATKINS AND COMPANY

404 So. Illinois Street Indianapolis, Ind.

(Continued from page 68)

The writer feels that an automobile department doing a large amount of production repairwork for the purpose of training its students, is doubly blessed, because it has the opportunity of checking up on how well it has instructed its students in fundamentals and trained them in skills for the job. In the final analysis, the question to be answered is: Can the student do enough work to earn wages, and has he been trained to have the proper attitude toward his work so that he will be able to use the knowledge and skills he has gained, to advance himself to a better job after entering the trade?

Summary

This trade-training program gives the young man who is just beginning to mature definite trade instruction for a total of 1500 clock hours or the equivalent of 187 eight-hour working days. Throughout this time the instructor's effort is to teach the student fundamentals, and to teach them well. The teacher must remember that there is little danger of being too elementary, and that it is extremely easy to train beyond the needs of the student. He should frankly take the attitude that if the trade can teach a young man as much as the school does, in the same time and at the same or less cost, it is time to close up his school shop.

The School Shop and Leisure

THE HOME WORKSHOP

Ross C. Cramlet, Des Moines, Iowa

The industrial-arts teacher should naturally be interested in the home workshop, hence the home-workshop guilds ought to receive his warmest support.

The home-workshop move, as sponsored by several of the home-crafters' magazines, has developed with much enthusiasm and interest during the past year. Such developments usually occur slowly unless there are certain human factors which supply a need. This home project has been observed by the progressive industrial-arts teacher all over the country with much interest because it has such a close relationship to the industrial-arts program in the school.

Many of our teachers have been rather slow and indifferent to fall in line, or to offer their services to the organization because they have had a feeling that many of the members were not skilled craftsmen, and that they would likely lack sufficient enthusiasm to stay by the work long enough to acquire a high standard of craftsmanship. In other words, they have looked upon a hobby in the light of a trade. This is perhaps a mistake, and is not in accord with the viewpoint which the good teacher is compelled to take as he goes about in his daily activities. It would seem that the home-workshop move is one of the best answers we have in sight at the present time for the development of the objective of industrial-arts work pertaining to the worthy use of leisure time as it would function in a mature life.

There are many very desirable features in a project of this kind from the standpoint of education. The benefits of these possibilities may be generally classified as mechanical and social, and relate perfectly to the experiences of any individual in any walk of life.

The industrial-arts department in the public school has been placed with little effort on its part in a position where it will receive due credit for any help which it may render to the promotion of the work. The advisory council of the Home-Workshop Guild has always suggested to local organizations in the developmental stage to call upon the local industrial-arts teachers for help in organizing and carrying

(Continued on page 17A)

ADVERTISING PAGES REMOVED

(Continued from page 14A)

on the program. This attitude on the part of the council has therefore presented an opportunity which is waiting in every community for the teacher of industrial arts. There are numerous elements of good which may come from a program of this kind in any community. Some of the more common ones are listed in the following:

1. It increases the ability of the individual to use his spare time more profitably.
2. It creates an interest in the home which will keep the members therein.
3. It stimulates a close friendship and a common interest between father and son in many instances.
4. It creates a wider acquaintance and interest in the industrial-arts teacher and his program in the school.
5. It enables the head of the family to save money in many respects.
6. It stimulates a type of thinking which leads the individual to be more resourceful.
7. It develops personal pride, thrift, and interest.
8. It increases the ability of the individual to fill the place of handyman in the home.
9. It instills confidence in the individual which leads to accomplishment.
10. It develops better judgment as to value of many commodities used in the home.
11. It stimulates incentives for good order, handy devices, and articles which might beautify the home and its surroundings.
12. It increases earning power in many cases.
13. It stimulates an attitude of industriousness.
14. It brings about a realization on the part of parenthood as to value of an intense interest.
15. It possesses high recreational value because of its appeal to the natural interest of the individual involved.

Shop Courses

COURSE IN ELECTRICAL WORK

H. R. Goppert, High School, Mishawaka, Indiana

The courses outlined in this article cover both the industrial-arts as well as the vocational work covered in high school.

THE electric-shop courses in the Mishawaka High School are laid out with two general objectives in view: First, to give the general student a broad view of the whole subject without any specialized training, and second, to give an intimate knowledge of electricity and electrical apparatus which is essential to the man who wishes to make a success in any trade branch of electrical work.

In order to accomplish the two widely varying objectives given above with the highest possible efficiency, two courses have been laid out with the second following and depending on the first. These courses are, first, one teaching the fundamental principles, which will be useful to anyone, called "Principles of Electricity," and second, the "Vocational Electric Shop" course which should prepare a boy to enter the various electrical trades and make more of a success than might otherwise be possible.

The first, being a general course, deals only with simpler principles which will be useful to anyone in any occupation with emphasis laid on points which will make more intelligent users of electricity. Since this use is becoming more general every day, this objective is possibly the most important, but the course is also intended to teach fundamental principles to the students who may elect to study electrical work for

(Continued on page 18A)

Specify ALGOMA plywoods. Get the satisfaction that we build into them. Watch your pupils turn out better projects when you give them these better woods.

●

They cost no more than the most interesting of solid woods; frequently they cost less. But, they are superior on every count.

●

Ask for the ALGOMA catalog and price list from the Algoma warehouse nearest you.

●

Then, select a group of mixed woods for a trial. We'll assemble your selections, crate and ship them f-a-s-t on the day we receive your order.

●

Thousands of instructors now specify ALGOMA plywoods. They find that it enables their students to produce projects that are better than when they use solid wood.

Here are the reasons: Algoma wood does not warp; nor shrink; nor swell; nor crack; nor blister; except under impossibly difficult conditions. It is well seasoned and easy to cut, fit and finish. It is stronger than solid wood. It is easier to join and will nail without splitting. It is sanded smooth, ready for any desired finish. It always has a strikingly beautiful surface.

Ask our office nearest you for the catalog and then send us a trial order; it will come to you fast.

ALGOMA PLYWOOD & VENEER CO.

Plywood Mills and General Offices, Algoma, Wisconsin
Veneer Mills—Birchwood, Wisconsin

Cincinnati, 634 Eden Park Entrance, Cherry 7823 • Chicago, 1234 N. Halsted St., Diversey 4342 • Cleveland, 5400 Brook Park Rd., Shadyside 1400 • Detroit, 15530 Idaho Ave., Longfellow 6338

Algoma
THE BETTER PLYWOOD

THE SERVICE COMPLETE For The METAL CRAFT SHOP

Within the 5 Departments of our service outlined below can be found every possible requirement of the Instructor of Metal Crafts.

Dept. M—MATERIALS "HARD-TO-GET"

Furnishes Bars and Sheets in Iron, Brass, Copper, Pewter, etc., Screws and Rivets, etc. Also "Hard-To-Get" materials as Ornaments, of endless variety, fancy Trim and Tubing, etc. and our "Special" Paints for Iron Finishes.

Dept. T—METAL WORKING TOOLS

Furnishes anything from Hammer and Anvil to Vise, Files, Forges, Drills and other Handtools. Especially noteworthy are Embossers Hammers, Stakes, Mallets, Chasing Tools and a number of others of our own design.

DEPT. H—METAL CRAFT DESIGNS

Furnishes Jobsheets of artistic design in Wrought Iron and the Metals. We now have 26 of them for the pupils from eight to eighteen. Kits of Materials for each project are also furnished.

Dept. P—PUBLICATIONS & TEXTBOOKS

Furnishes Textbooks on Metal Work, carefully selected for good technique and design. Also our own Design Booklets "Art in Iron", covering every type of wrought iron project.

Dept. D—SPECIAL DESIGNING

Furnishes special designs and details to your own requirements, also blueprint jobsheets for projects selected from "Art in Iron".

To make these 5 Departments of still greater value, we offer our FREE ADVICE AND CONSULTING SERVICE.

Our 56 page catalogue will be sent on receipt of 25c refundable with orders for $5.00.

(Continued from page 17A)

a life occupation, either by taking engineering courses or by taking the trade course which follows it in our school.

The vocational course follows and depends on the first or elementary course, and the student must have taken the latter before he is prepared to enter the trade course. This course as outlined here gives enough knowledge of fundamental principles and experience in handling tools, materials, and machines so that the boy who has completed it will be able to start work as helper in any branch of the electrical trades, and advance more rapidly than he could without having had the course.

No attempt is made to develop tradesmen in any particular line of electrical work, such as motor winders, telephone repair men, or cable splicers, since these are practically individual trades in themselves and require too much special training for this course, which must be more or less general. However, since the course is laid out with great flexibility in mind, it is possible for a student to specialize to some extent in any line of work in which he is interested.

It has been found, after several years' experimenting, that best results are obtained in a shop such as this one, by outlining a minimum list of jobs to be done and then permitting the boy himself to go as much further in study as his ability and inclination lead him. Since the limited equipment available prevents any large group working on the same job at one time, a great deal of the instruction must be individual, and this also tends to encourage the boy to depend on his own initiative. Every effort is made to train the boy to depend on himself for all the work and planning of which he is capable.

It is impossible to make an electrician of the student with the time and limited equipment available, but our graduates have gone out and made good on jobs in a great many branches of the electrical trades.

Objectives for the Introductory Course

1. To give a background of information and explanation of all electrical phenomena which a student will meet in his daily life.
2. To enable a student to do various home-mechanics jobs; that is, make simple repairs which he will find necessary throughout his daily life.
3. To help the student, by his understanding of the principles involved, to select and use various electrical appliances intelligently.
4. To enable the student to learn enough about the type of work involved that he will know whether he would like to make electrical work his job for life.
5. For the student who chooses electricity as a vocation, these courses will teach the fundamentals which form a foundation for his further study whether it will be on a trade basis or on professional levels.

Objectives for the Vocational Course

1. To study the nature and uses of the large variety of materials which are used in connection with electrical apparatus, and get some experience in working with them.
2. To learn the various circuits and construction methods used in connecting and controlling all kinds of apparatus.
3. To study the principles of operation and phenomena involved in the various electrical machines.
4. To work with various types of machines and controls for the purpose of learning how they are constructed.

Methods

Since all the work offered must be mastered individually, the jobs are done in small groups where possible, and each group progresses independently of the others. Job sheets are used for presenting the material and make use of a great deal of reference material for the related theory.

Also a textbook is followed in the two courses, since this helps to put responsibility on the boy, for his progress. Where it is practical, lectures are used to supplement the students' study and to emphasize the important points.

The elementary courses use wiring jobs and experiments for the boy's work. Most of the wiring jobs use bells or buzzers for illustrating common circuits, and the experiments consist of a series of tests of commonly used apparatus which

(Continued on page 20A)

Look for " TRADE MARK Jorgensen " on CLAMPS

REG U S PAT OFF

It is not enough to specify "Jorgensen" when ordering. Look for the "Jorgensen" Mark and be sure that you get them. Standard throughout industry. Genuine Jorgensens never slip or stick; jaws never split or spring; handles never loosen nor spindle nuts jam. Look for the "Jorgensen." It guarantees lifetime service.

Jorgensen "HIGH-SPEED" Steel Bar Clamps come in six improved types with patented Multi-Disc Clutches that "zipp" to position—hold at any point on the bar. They cut tightening time to a fraction; have strength beyond any need.

"Pony" Clamps are designed, manufactured and guaranteed by Jorgensen. Pony 300 Fittings are recommended for schools because they go on ordinary ¾" pipe to make clamps of any length—provide low-cost, light, strong clamps for work of any size. Equipped with Multi-Disc Clutches. Several types.

"Pony" Miniature Clamps have "a million uses" on both delicate and large work. Sold at toy prices, they are, strictly speaking, quality tools.

Write for:

General Clamp Catalog

"How to Use Handscrews", sent free to instructors.

Quality miniature Clamps — Made with best malleable iron frames cadimum plated. Steel screws with deep standard threads, freely turning swivels, loose pin handles.

ADJUSTABLE CLAMP CO.

"The Clamp Folks"

424 N. Ashland Ave., CHICAGO

NORTON PIKE

Accepted

BY FIRST CLASS MECHANICS THE WORLD OVER . . . . .

NORTON PIKE INDIA

OILSTONES

Bench Stones · Slips Shapes

Send for your copy of the "How to Sharpen" booklet. All about keeping edged tools in good condition.

BEHR-MANNING

TROY, N. Y.

SALES REPRESENTATIVES IN U S A FOR NORTON PIKE

FOR VISES—SPECIFY "MORGAN"

They don't cost any more. Are unsurpassed for strength, rigidity and durability. Guaranteed against breakage. Any part broken in service replaced free of charge. When through wear it becomes necessary to replace parts, this is easily accomplished because special machining allows interchangeability of all parts.

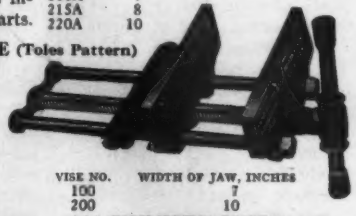
CONTINUOUS SCREW PARALLEL BAR VISE

Adjustable Steel Handle—Stop in Front Jaw Wood Handle Furnished If Desired. Furnished with or without stop in front jaw. Faces drilled for installation of wood faces.

VISE NO.	WIDTH OF JAW, INCHES
210A	7
215A	8
220A	10

QUICK ACTION VISE (Toles Pattern)

Has unusually effective and durable working action. Screw is 1¼" in diameter. Half nut of high quality bronze with accurately cut threads. Furnished with or without dogs in front jaw.



VISE NO.	WIDTH OF JAW, INCHES
100	7
200	10

MACHINISTS' VISES

Unsurpassed for strength and durability.

Swivel Base Machinists Vise

STATIONARY BASE Vise No.	Width of Jaws, Inches	SWIVEL BASE Vise No.	Width of Jaws, Inches
30	3	130	3
35	3½	135	3½
40	4	140	4
45	4½	145	4½
50	5	150	5

We will gladly quote on your requirements or send illustrative material upon your suggestion to do so.

WRITE

MORGAN VISE CO.

120 N. Jefferson St., Chicago, Ill.

4 TIMES FASTER

Than Hand-Planing

THE AMERICAN SANDERPLANE

FOR YOUR SCHOOL SHOP

While they are learning your manual training students might just as well have the advantage of using the fastest and most modern tools and equipment. It's impossible to use old ideas and methods to give them the full benefit of a MODERN, UP-TO-THE-MINUTE Vocational Education.

PUT IN SANDERPLANES—AND,—don't forget—they'll work out perfectly on many other applications, Resurfacing blackboards—Refinishing school desks, etc.

AMERICAN

FLOOR SANDING MACHINES

FLOOR WAXING AND POLISHING MACHINES

FLOOR TREATING MATERIALS

Write for literature

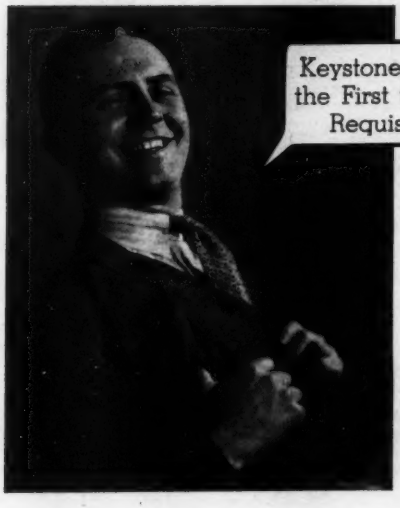
THE AMERICAN FLOOR SURFACING MACHINE CO.

517 South St. Clair St.

TOLEDO, OHIO

Branches in Principal Cities

this YEAR
THE GLUE STORY'S
different!



It all started out with our "Free Test Sample" Offer. Hundreds of Instructors took advantage of it, tested the samples under actual schoolshop conditions, and *this* year they're specifying Keystone *Pure Hide* exclusively for their glue requirements. They've found that *the strength is there to stay!*

Keystone Glue Company
Manufacturers of Pure Hide Glue Exclusively
Williamsport, Pa.

FREE!
To bonafide schoolshop Instructors and Supervisors, this unusual and valuable book on the History, Manufacture and Correct Use of Pure Hide Glue. Write for your copy *today!*

(Continued from page 18A)

will help in the intelligent selection and use of household electrical appliances. One or two production jobs are done to help teach the construction of apparatus, though here is one point where considerable latitude of choice is given.

In the vocational courses the jobs are done from job sheets or on the basis of production testing where the worker outlines his own jobs to a certain extent.

Individual differences in preparation, and otherwise, greatly affect the amount of mathematics the student is expected to master. Every effort is made to keep the work on a strictly trade level, and to avoid the mathematics of the semiprofessional engineering level which is coming to be recognized as "Junior Engineering."

A great deal of construction work and production is used for the purpose of teaching the use of materials and their properties, as well as the principles involved in the appliances built.

In both courses every effort is made to lead the student to develop initiative rather than depend on the leadership of others, and, for him to "learn by doing" as much as possible though from the nature of the subject considerable study is required.

Time

The course in "Principles of Electricity" is divided into two semesters' work. Electricity I and Electricity II with classes one hour a day five days a week.

Vocational classes are held three hours a day, five days a week for four semesters, or more for the student who desires more.

Subject Matter Outlined

Electricity I

Make common joints.
One bell controlled by one push button.
Two bells in parallel controlled by one push button.
Two bells in series controlled by one push button.
Two buzzers in parallel controlled by separate buttons.
One buzzer controlled by any of three buttons in parallel.
Three-wire return-call system.
Two-wire-and-ground return-call system.
Four lamps in parallel with cutout.
Pilot light on switch controlling lamps.
Study of static electricity.
Study heating effect of current and resistance.
Test voltaic cell.
Study the magnetic field about a conductor.
Study chemical effects of current.
Study field of a magnet.
Methods of making a permanent magnet.
Study effect on voltage of connecting battery cells in series and parallel.
Problems on voltage of series batteries.
Problems on current of parallel batteries.
Study use of ammeter and voltmeter on lamp.
Experimentally, confirm Ohm's Law.
Problems on Ohm's Law.
Make an electromagnet.
Special production jobs as time permits.

Electricity II

Three-wire return-call bell system.
Two-apartment door and janitor signal system.
Three-circuit annunciator system.
Night buzzer system.
Small apartment house signal system.
Two-light outlets in parallel, using knobs.
Two single-pole single-throw switches in parallel.
Two single-pole single-throw switches in series.
Two-point control using knife switches.
Two-point control using three-way snap switches.
A complex arrangement of switches and lamps.
A second complex arrangement of switches and lamps.
Study current and voltage distribution on two lamps in series.
Study current and voltage distribution on two lamps in parallel.
Problems on resistance of wire.
Problems on resistance of a circuit.
Check a wattmeter against a voltmeter and ammeter.
Measure power and cost of operating various types of lamps.
Measure power and cost of operating a toaster.
Measure power and cost of operating a flatiron.
Use a kilowatt-hour to measure energy used.

(Continued on page 38A)

The Right

PRINTING INKS

for Schools

It's all a matter of selection. And choosing the proper source of supply is the first and most important concern.

Our reputation for quality and value in printing inks has been gained by experience in working out numerous pressroom problems. Let us help you select the Right ink for the Right purpose and you'll have it at the Right time.

Ask for a color chart or have a technical expert call

FRED'K H. LEVEY CO., INC.

Printing Inks of all Descriptions

59 Beekman St., New York City

1223 Washington Ave. Philadelphia — **221 E. 20th St. Chicago, Ill.**

"ROUSE" PRINTSHOP TOOLS

for Apprentice and Master—

ROUSE COMPOSING STICKS

Especially made for school work. Sturdily constructed, notably low priced. Five other types available including the famous Rouse "Quarter Point" and "Micrometer" sticks.

ROUSE MITERING MACHINES

The trade's most popular miterer. Equipped with positive point gauge. "Panameric" Miterer is a lower priced model.

AMERICAN LEAD and RULE CUTTERS

No. 20

The No. 20 is only one of five cutters available. This model especially suitable for school print shops.

Detailed information on all equipment sent on request.

H. B. ROUSE & CO.

2214-16 Ward St. Chicago, Ill.

SCHOOL SHOP TOOLS FOR TEACHING AND LEARNING

A nationally known industrial educator recently said that *related information* constitutes the heart of any school shop program. Other educators declare that books deserve a rating as teaching tools on a level with the most important shop equipment.

Modernize your Courses with Up-to-date Teaching Tools

International Texts are keen edged tools that cut right through to the heart of school shop programs.

A partial list of teaching tools:

AUTOMOBILE

Automobiles and Automobile Engines	173 pp.,	104 illus.,	$1.75
Automobile Electric Equipment (3 Vols.)	348 pp.,	158 illus.,	3.75
Automobile Transmissions	182 pp.,	79 illus.,	1.75

BLUEPRINT READING

Reading Shop Blueprints (with blueprints)	136 pp.,	95 illus.,	$1.80
Reading Architects' Blueprints	174 pp.,	97 illus.,	2.00

BUILDING TRADES AND WOODWORKING

Carpentry (3 vols.)	481 pp.,	353 illus.,	$5.00
Carpentry Job Sheets	336 pp.,	374 illus.,	4.20
House Planning	134 pp.,	85 illus.,	1.40
Painting and Wood Finishing	156 pp.,	90 illus.,	1.75

DRAFTING AND SKETCHING

Architectural Drawing (w. draw. plates)	157 pp.,	94 illus.,	$2.25
Machine Sketching	82 pp.,	83 illus.,	1.00
Mechanical Drawing	114 pp.,	69 illus.,	1.50

ELECTRICITY

Electrical Measuring Devices	101 pp.,	73 illus.,	$1.00
Interior Wiring. Electric Signals	155 pp.,	230 illus.,	1.75

METAL WORK

Green-Sand Molding	184 pp.,	157 illus.,	$1.75
Lathe Work (3 Vols.)	465 pp.,	471 illus.,	5.00

PRINTING

Progressive Lessons in Printing (40 lessons)	134 pp.,	39 illus.,	$1.50

RADIO

Radio Amplifiers	176 pp.,	93 illus.,	$1.75
Radio Transmitters	166 pp.,	71 illus.,	1.75

VOCATIONAL GUIDANCE

Occupational Studies	81 pp.,		$1.00
The Printing Trades and Their Workers	132 pp.,	66 illus.,	1.40
Vocations in Industry (3 vols.)	826 pp.,	279 illus.,	7.00
Manual to Accompany Vocations in Industry	120 pp.,	44 inserts	2.00

OTHER GROUPS OF TEXTS COVER:—

Air Conditioning, Aviation, Chemistry, Commercial Art, English, Gas Engines, Heating and Ventilation, Mathematics, Patternmaking, Plumbing, Refrigeration, Salesmanship, Sheet Metal, Steam Engineering, Toolmaking, Telegraphy and Telephony, Textiles, and Welding.

Most of these books are also published in pamphlet form.

Catalog sent on request.

INTERNATIONAL TEXTBOOK CO.

INTERNATIONAL TEXTBOOK CO.
Box 8905-E, Scranton, Penna.

☐ **Please send me on approval your texts on the following subjects:**
☐ **Please send me prices of your texts on the following subjects:**

.....
.....
.....

I agree to return texts if not adopted or to remit for same.

NAME.....
POSITION.....
SCHOOL.....
ADDRESS.....

Printshop Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.
Bellows	
Hand, small-size	
Electric, blower-type	
Blackboard, permanent or portable	
Bookcase, for reference books, catalogs, etc., sectional preferable	
Brayer, 6- or 8-in., for proofing	
Brushes	
Bench	
Benzine, No. 1, oval back	
Padding, 1½ in. wide	
Bulletin Board	
Cabinets	
Galley, for double-column galleys, wood or steel, four tiers (to be used with typesetting machines)	
Galley, for 8¾ by 13-in. galleys, wood or steel, four tiers	
Ink and Roller, to accommodate platen-press rollers, wood or steel	
Matrix, for use with typesetting machines only	
Roller, cabinet or rack for cylinder rollers	
Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine	
Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copy holder	
Type, complete with 24 full-sized California job cases, with overhead lead-and-slug cases, wood	
Type, complete with 24 full-sized California job cases, double work bank, wood or steel	
Wood or metal, for filing class records, instruction sheets, etc	
Blank, full size, to accommodate ¼-size cases	
Border, ¼ size, for ornamental borders	
Lead and Slug, regular size, to hold labor-saving fonts of leads and slugs	
Metal Furniture, to hold labor-saving fonts	
Rule, ¼ size, for brass rule	
Cans	
Benzine, pint size	
Benzine, 5-gal. size	
Kerosene, safety, 1-gal. size	
Waste Can, fireproof, for rags	
Chairs, tablet-arm	
Chases, (for each size of platen press)	
For cylinder press	
Chase Racks	
For platen presses	
For cylinder presses	
Composing Sticks	
6 x 2 in., adjustable	
8 x 2 in., adjustable	
12 x 2 in., adjustable	
18 x 2 in., adjustable	
Cutter	
Lead and Rule	
Paper, lever-type, 20-in., with pedestal. Should handle 20 by 26-in. sheet	
Paper, lever-type, 26 or 30 in	
Paper, lever-type, 30-in., with divided back gauge, or 30 to 36-in power cutter	
Desk	
Teachers', with drawer compartments	
Chair to match	
Drying Racks	
Combination drying rack and stock table for platen presses, 30 trays	
Trays, interlocking, for cylinder press	
Folding Bones, (for hand folding)	
Folding Machine	
20 by 26-in. size, 4-fold, two parallel and two right-angle folds, power	
Ink Fountains	
Short, for 8 by 12 press	
Short, for 10 by 15 press	
Long, for 10 by 15 press	
Short, for 12 by 18 press	
Long, for 12 by 18 press	
Furniture	
Iron, 2 by 4 to 10 by 15 picas, fonts	
Galleys	
Steel, 8¾ by 13 in	
Steel, 6¼ by 23½ in., double column	
Steel, 12 by 18 in	
Gauge Pins, spring-tongue, doz	
Glue Pot, electric, 1-qt. size	
Imposing-Tables	
12 by 18-in., with iron top, including reglets and furniture	
24 by 36-in., with iron top, complete with galley slides, chase rack, reglets, and furniture	
36 by 48-in., with iron top, complete with galley slides, chase rack, reglets, and furniture	
39 by 63-in., with iron top, complete drawers, letter boards, reglets, and furniture	
Knives	
Overlay, for make-ready	
Ink, 6 in., round end	
Ink, 8 in., round end	
Ink, 8 in., square end	
Leaders	
6-pt. fine dot, lb	
8-pt. fine dot, lb	
10-pt. fine dot, lb	
8-pt. hyphen, lb	
10-pt. hyphen, lb	
Leader Boxes	
Line Gauges	
Metal, brass, or steel	
Wood, doz	
Metal Furnace, for recasting and refining type metal, used only with typesetting machines	
Mitering Machine	
Numbering Machines	
For use on presses	
Hand machines	
Ornaments	
Assorted floral and decorative designs	
Border, 6-point, decorative, fonts	
Border, 12-point, decorative, fonts	
Perforator	
24-in., foot treadle	
28-in., foot treadle	
Planer	
Mallets, hickory or fiber	
Proof, maple, with felt bottom	
Type, maple, with leather top	
Presses	
Cylinder, two-revolution, four-roller, 25 by 38, complete with variable-speed motor, cast rollers, etc	
Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake and set of cast rollers. (Motor and treadle combination if desired)	
Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc	
Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc	
Proof, 14 by 18, with cabinet	
Proof, 20 by 24, with cabinet	
Punch	
Foot-power, multiple, with assorted punches	
Lever, two-die, with assorted punches	

(Continued on page 24A)

American Type Founders

Department of Education employs the services of Professional Educators and Experienced Engineers to aid you in the complete organization and installation of your School Printing Department

No. 9190 American Ideal School Type Cabinet, the wise selection for many Junior High Schools

The No. 9190 American Ideal School Type Cabinet

Is especially designed for use in the Junior High Schools. The double working bank top accommodates two pupils at a time in setting type. The cabinet contains one No. 2701 Blank Case, thirteen No. 2735 California Job Cases and two No. 2765 Wells Two-font Cases—all cases full size. Where desirable, this cabinet may be ordered without overhead lead and slug rack, and with lead and slug case. A quality cabinet (Hamilton construction) economically priced.

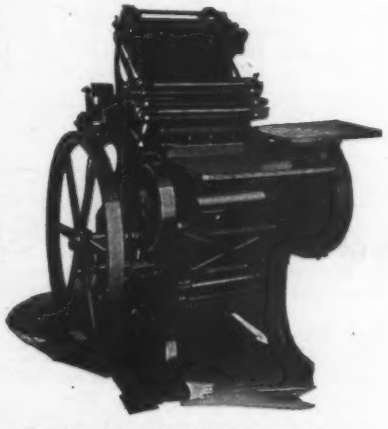
The School Printing Department is as vital to the Educational and Social life of the school as the newspaper is to the community.

No. 870 American Perfection School Type Cabinet, the choice of many Senior High Schools

The No. 870 American Perfection School Type Cabinet

This up-to-date cabinet of steel construction in olive green finish, with working bank top sloping both ways and handy lead and slug rack under both edges of the top, provides normal accommodations for four pupils at a time in typesetting. Two pupils working at each side have between them a complete equipment of type, spacing materials and galley dump. There is no superstructure on this cabinet to obscure the instructor's view of his students. Designed for Senior High Schools and Teacher Training Institutions.

Education Through Printing is the application of the "Learn by Doing" philosophy.



Chandler & Price New Series Printing Press with attachments

Chandler & Price Presses

Are in general use in all School and Commercial Printing Plants. Four popular school sizes. The 6½x10 hand operated Pilot Press for General Shop Units. The 8x12, 10x15 and 12x18 (chase sizes) for all schools. The Chandler & Price Presses may be operated by foot or motor power.

Printing (The Mother of Progress) develops creative ability through the application of care, precision, good judgment and education in purposeful activity.

School printshop equipment should not only conform to the best modern practice in commercial printshops but also should be adapted to instruction conditions with due regard for efficient class management. The items here shown have been designed to meet these conditions. For the Trade or Vocational School we recommend Cut-Cost equipment for the composing room and the Kelly Flat Bed Automatic Press for the pressroom.

Everything for the school printshop—cabinets, presses and general supplies for both the presaroom and composing room.

WRITE FOR INFORMATION

American Type Founders Sales Corporation

DEPARTMENT OF EDUCATION

Jersey City, New Jersey

BRANCHES AND SELLING AGENTS IN TWENTY-FIVE CITIES

Type used: Century Schoolbook Family and Schoolbook Oldstyle

(Continued from page 22A)

Name and Description	No.	Name and Description	No.
Power, multiple, with assorted punches. (Paper drill may be substituted)		Slugs, labor-saving, 6-point, lb.	
Quoins		Slugs, 2-ft. strips, 6-point, lb.	
No. 1 size, doz.		Spaces and quads	
No. 2 size, doz.		Thin spaces, brass and copper, assorted sizes, 6 to 18 points, one size in each box, sets	
Keys, No. 1 size		*Specimen Display Board*	
Keys, No. 2 size		*Staple Binder*, pedestal-type, foot power	
Rule, plain, brass, (fonts to fit quarter cases)		*Stitcher*, wire, power, capacity ½ or ¾ in., flat and saddle-back tables	
2-point, labor-saving, hair-line, side face, fonts		*Tympan Paper*, (with combination holder and cutter)	
2-point, labor-saving, 1 point side face, fonts		18-in., rolls	
1-point, labor-saving, 1 point face, fonts		38-in., upright, to be used with cylinder press only	
2-point, labor-saving, double face, fonts		*Typesetting Machines*, either linotype or intertype, 2 or 3 magazines, and molds	
Saw Trimmers, pedestal type, with point gauge, and raising and lowering table		Matrices for same, 6, 8, 10, and 12-point, as selected, fonts	
Spacing Material		Tweezers, 3½-in., doz.	
Iron furniture, as selected, fonts			
Leads, labor-saving, 2-point, lb.			
Leads, 2-ft. strips, 2-point, lb.			

Name and Description	No.	Name and Description	No.	Name and Description	No.
Type		18-point, No. 30, fonts		12-line, fonts	
Body, Lightface—		Job, Light Copperplate Gothic—		15-line, fonts	
8-point, lb.		6-point, No. 1, fonts		18-line, fonts	
10-point, lb.		6-point, No. 2, fonts		10-point, fonts	
Job, Lightface—		6-point, No. 3, fonts		12-point, fonts	
6-point, fonts		6-point, No. 4, fonts		14-point, fonts	
8-point, fonts		12-point, No. 5, fonts		18-point, fonts	
10-point, fonts		12-point, No. 6, fonts		24-point, fonts	
12-point, fonts		12-point, No. 7, fonts		30-point, fonts	
14-point, fonts		12-point, No. 8, fonts		36-point, fonts	
18-point, fonts		Job, Condensed Title Gothic—		48-point, fonts	
24-point, fonts		12-point, fonts		60-point, fonts	
30-point, fonts		18-point, fonts		72-point (caps only), fonts	
36-point, fonts		24-point, fonts		Job, Boldface Italic—	
48-point, fonts		36-point, fonts		8-point, fonts	
Job, Lightface Italics—		48-point, fonts		10-point, fonts	
8-point, fonts		60-point, fonts		12-point, fonts	
10-point, fonts		72-point, fonts		14-point, fonts	
12-point, fonts		Job, Text Type—		18-point, fonts	
14-point, fonts		10-point, fonts		24-point, fonts	
18-point, fonts		12-point, fonts		30-point, fonts	
24-point, fonts		14-point, fonts		36-point, fonts	
36-point, fonts		18-point, fonts		Job, Heavy Copperplate Gothic—	
Job, Boldface—		24-point, fonts		6-point, No. 21, fonts	
6-point, fonts		Job, Typewriter Type—		6-point, No. 22, fonts	
8-point, fonts		12-point, with spaces, lb.		6-point, No. 23, fonts	
12-point, No. 26, fonts		Wood, Condensed Gothic—		6-point, No. 24, fonts	
12-point, No. 27, fonts		8-line, fonts		12-point, No. 25, fonts	
12-point, No. 28, fonts					

Supplies

Name and Description	No.	Name and Description	No.
Benzine or Gasoline, for cleaning type or presses, gal.		Bond, sulphite, 17 by 22 — 16, white, reams	
Bindery Tape, 2 in. wide, brown or black, rolls		Bond, sulphite, 17 by 22 — 16, colors as selected, reams	
Gold Bronze, pale, lb.		Book, enamel, 25 by 38 — 80, white, reams	
Gold Size, lb.		Book, machine finish, 25 by 38 — 80, white, reams	
Ink		Book, eggshell finish, 25 by 38 — 60, white, reams	
Bond, black, for bond papers, lb. cans		Cover, as selected, sheets 20 by 26, medium	
Book, black, for school paper, etc., lb. cans		Card Bristol, fine grade, 22 x 28 — 4 ply, white, sheets	
Cover, colors as selected, lb. cans		Index Bristol, medium grade, 25½ by 30½ — 110, white, sheets	
Cover, colors as selected, ½-lb. tubes		Index Bristol, medium grade, 25½ by 30½ — 140, white, sheets	
Dryers and Compounds, as selected, lb. cans		Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected, sheets	
Halftone, black, lb. cans		Press Board, red, sheets	
Job, colors as selected, lb. cans		Strawboard, No. 40 or No. 50, bundles	
Job, colors as selected, ½-lb. tubes		Tag Board, manila, 24 by 36 — 140, sheets	
Metallic, gold and silver, lb. cans		Tympan, to fit presses, rolls	
Process, black, red, yellow, blue, lb. cans		Wrapping Paper, size as selected, rolls	
Kerosene, for cleaning rollers, gal.		Holder for same	
Padding Cement		*Twine*, cotton, for tying jobs, lb.	
Cold, gal.		*Wire Stitching*	
Hot, lb.		No. 25 round wire for stitcher, spools	
Paste, Bindery, pints		Wire Staples, ¼ in., for stapling machine, 5,000 in box, boxes	
Make-ready, lb.			
Paper			
Bond, fine grade, 17 by 22 — 16, white, reams			
Bond, medium grade, 17 by 22 — 16, white, reams			

Western States Envelope Co.

1616 West Pierce St., Milwaukee, Wis. **Long Distance Phone Orchard 9310**

Manufacturers of

Felt Brush Gummed Envelopes

We are closely affiliated with the printing trade, and through years of study have been enabled to work with and help solve the envelope requirements of modern business.

All of this experience is available to school print shop instructors. The envelope requirements of modern business have become so varied that it is important that every boy entering Industry be properly informed.

What We Are—What We Make What We Do

THE WESTERN STATES ENVELOPE COMPANY was organized May, 1908, with one idea in mind, namely — that of operating an envelope factory that would do as printers would do if they were running it themselves.

We have done as much for you or even more than you would have done for yourselves had you been in our place; in fact, it can truthfully be said at this time that we are "YOUR ENVELOPE MANUFACTURER." Operating your Envelope Service Station.

Our first business is to plan and develop the envelope business in the interests of the printer and lithographer.

WE ARE EMPHATICALLY INDEPENDENT IN EVERY WAY.

WE MAKE all the regular sizes of commercial and official envelopes, from six to fourteen, including the special flaps of which we have over thirty-nine different styles. See Trade Circular No. 2.

Envelope Trade Names and Sizes

6¼ Commercial	3½ x 6	10 Official	4⅛ x 9½
6¾ Commercial	3⅝ x 6½	11 Official	4½ x 10⅜
7 Official	3¾ x 6¾	12 Official	4¼ x 11
7½ Two-fold	3⅞ x 7½	14 Official	5 x 11½
9 Official	3⅞ x 8⅞	6¾ Reverse Face	3⅝ x 6½
10 Reverse Face	4⅛ x 9½		

Included in our complete line of envelopes are a full range of Look-In, Window, Bankers Flap, Catalog, Coin, Collection, Baronial Catalog, Report Card, or any other kind of envelope you may possibly want. We also make special envelopes of all sizes and kinds from any paper. Seed envelopes for packaging seeds and small parts available in several sizes.

In addition we carry a complete line of die-cut cards for all purposes in kid, plate, and linen finishes. Our visiting cards may be furnished plain or panelled. Our line of wedding and announcement stock is very complete. Also round corner cards in white and colors suitable for tickets, meal checks, etc. Write for samples and prices.

A Print Shop Project

Why not have your school print shop print all of the envelopes for your school, or for that matter, for your entire school system? We have every variety of size and grade available. We shall be pleased to furnish the paper and layouts for flat printing or just layouts for you to print on stock which you may have on hand, we to make the envelopes up after you are through printing. We have worked out this service particularly well and shall be pleased to coöperate with you in this way. The "Guide Book" described in the next column should have a place in your school print shop, as it is very instructive. Do not fail to send for it.

Guide Book through Envelope Land

Write for This Informative Envelope Book

This book contains the following bonafide Trade Information

Pages 51, 52, 53, 54 and 55 list the Commencement, Greeting Card and Baronial sizes that we can furnish with style and type of flap given.

Page 65 gives the number of envelopes out of almost any size of paper.

Pages 62, 63 and 64 give prices for making envelopes from furnished stock, plain or printed.

Pages 68, 69, 70 and 71 give illustrations of different types and styles of envelopes.

Pages 58, 59 and 60 list unusual envelope papers not regularly carried in stock.

All the above is yours for the asking without any obligation.

Supplying envelope requirements for school systems is our specialty. We will gladly assist in making up your specifications, and will submit bids at any time, on any numbers of envelopes desired.

Envelopes are in stock for immediate shipment, in all grades of stock which include a numerous variety and quality of bonds and krafts.

Western States Felt Brush Gummed Envelopes

A New Type Envelope
which is guaranteed to eliminate gumming and envelope printing difficulties.

By this method the gum is brushed into the pores of the paper and on to the sealing portion of the flap. The flap is larger in size than usual which in addition to other advantages assures good sealing even with hard sized papers.

Felt brush gumming has been in use over two years and has been found very satisfactory. The presence of lumpy gum under the printing side the sealing flap has been eliminated and the tendency to dish, wrinkle or warp has been largely done away with. The design of the sealing flap is also new, and one that shortens make-ready time when printing envelopes.

Felt brush gummed envelopes are also scored before folding, thus assuring square envelopes that pack tightly and consequently occupy less space.

Western States Envelope Co., 1616 West Pierce St., Milwaukee, Wis.

MAXIMUM EFFICIENCY at MINIMUM COST

Rhodes combination 7-inch Shaper and 3½-inch slotter.

RHODES SHAPERS SLOTTERS

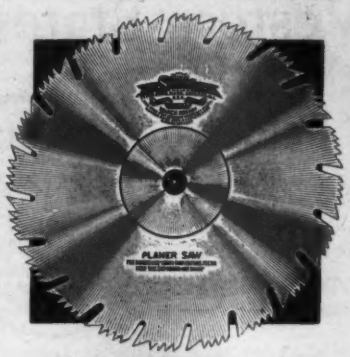
RMCo

Features afforded for Training Purposes:

1. General Shaping work.
2. General Slotting work with use of a rotary table on tools and dies.
3. Simplicity of construction makes it possible to use this machine as a model for detail and assembly drawings.

Write for complete information

The Rhodes Manufacturing Co.
Waltham, Mass.



SIMONDS DADO SAWS

By combining outside saws with inside cutters, clean grooves may be cut in any direction of the wood any width from ⅛ to 4 inches wide. When writing state widest groove to be cut.

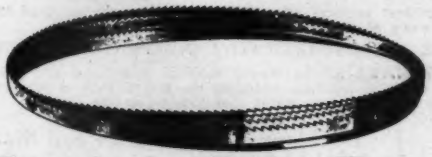
The Smooth Cutting
PLANER SAW

Cuts with or across the wood grain and leaves an edge smooth enough for glue joints. Saves time.

LIST PRICES (subject to discount)

6 inch $5.55	12 inch $11.20
8 inch 7.00	14 inch 13.40
10 inch 9.00	16 inch 15.80

Brown steel **BAND SAWS** any width or length.



Write for Saw Catalog

SIMONDS SAW AND STEEL CO.
Fitchburg, Mass.

AMERICAN STEEL SHEETS

FOR ALL KNOWN USES

AMERICAN

IN INDUSTRIAL SHOPS

Use sheet metals of recognized value and reputation—and adapted to all purposes. Our free booklet, "The Evolution of a Tin Can," describing briefly the processes of manufacture, will interest you.

Insist upon AMERICAN Black Sheets, Keystone Rust Resisting Copper Steel Sheets, Apollo Best Bloom Galvanized Sheets, Galvannealed Sheets, Heavy-Coated Galvanized Sheets, Formed Roofing and Siding Products, Tin Plates, Terne Plates, Black Plate, Etc.

Write us relative to your sheet steel requirements. This Company also manufactures USS STAINLESS and Heat Resisting Steel Sheets and Light Plates for all purposes.

AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh, Pa.

SUBSIDIARY of UNITED STATES STEEL CORPORATION

ART METAL and JEWELRY WORK EQUIPMENTS and SUPPLIES

We make a specialty of equipping and supplying schools, clubs and summer camps for this work and carry all kinds of materials used, including gold, silver, copper, brass, pewter aluminum and nickel silver, in sheet and wire form, and semi-precious stones.

"Rose" anvils and hammers.
The first to be used in school work. Beware of inferior substitutes. **Specify "Rose"** when ordering.

We take pride in our reputation for service. No order or request too small to receive our prompt and careful attention.

Our Brochure "The Metal Crafts" is full of helpful suggestions. Sample copy sent free. Subscription price for three issues, 50c.

Our new and enlarged catalog will be sent free to shop and craft teachers upon application if position is stated. To others it will be 25c. Full credit given on first order amounting to $5.00.

Metal Crafts Supply Co.
37 Aborn St., Providence, R. I.

Metal-Working Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.
Air Compressors, for machine shop, foundry, or forge shop	
Anvil, 100-lb.	
Arbor Press, bench or pedestal type	
Barrows	
Coke	
Foundry	
Scrap	
Belt Lacer	
Benches	
Coremaking	
For metal working, iron or steel legs. Tops metal or hardwood lumber 1¾ to 2½ in. thick	
Molding	
Blackboard	
Permanent or portable	
Blowers, for furnaces, forges, etc.	
Blowtorch, 1-qt. size	
Bookcase	
For reference books, catalogs, etc.	
Boring Bar	
Boring Mill, vertical or horizontal	
Bulletin Board	
Cabinets, wood or metal, for filing class records, instruction sheets, drawings, etc., or for tools and supplies	
Casehardening Boxes	
Centering Machine	
Chain Hoists, differential, duplex or triplex	
Chairs, tablet-arm if needed for related-subjects room, or demonstration section	
Chuck	
Drill, selected sizes, each	
Lathe, combination, 4-jaw, selected sizes, each	
Lathe, independent, 4-jaw, selected sizes, each	
Lathe, universal 3-jaw, selected sizes, each	
Milling machine, universal	
Core Oven, for foundry	
Cranes and Hoists, air, electric or hand, of the jib, traveling, or portable type	
Cupola, for foundry, coke or electric, ¼ to 1-ton capacity	
Desk	
Teacher's, with drawer compartments	
Chair, to match desk	
Die-Filing Machine	
Dividing Head	
Drill	
Bench, hand	
Breast	
Electric, portable	
Hand	
Post, hand or power	
Radial	
Sensitive	
Upright, power	
Flasks, 2 or 3 part, steel or snap type	
Forge, coal or gas, with hand- or electric-driven blower	
Furnaces	
Annealing	
Bench	
Brass and soft metal	
Combination bench	
Casehardening	
Cyanide	
Gasoline	
Heat treating	
Melting	
Gear-Cutting Machine	
Grinder	
Bench, hand or power driven	
Combination grinder, buffer and polisher	
Emery, bench or pedestal type	
Face, with magnetic chuck	
Portable tool post	
Precision, for external and internal grinding	
Universal tool-cutter, drill and reamer grinder	
Wet tool	
Hand Picks, for cleaning inside of cupola, 1¼ to 2½ pounds	
Hack Saw, motor or belt driven	
Hardness Testing Machine	
Lathes, belt or individual drives	
Automatic	
Bench, 6" to 11" swing, 11" to 36" between centers	
Change gear, 9" to 14" swing, 18" to 36" between centers	
Quick-change gear, 9" to 16" swing, 18" to 36" between centers	
Semiquick-change gear, 9" to 18" swing, 18" to 42" between centers	
Turret	
Milling Machine	
Plain, cone or motor-driven type	
Universal, cone or motor-driven type	
Nibbling Machine	
Pipe Cutter	
Planer, belt or motor driven	
Power Hammer, for forging operations	
Punches, metal, hand or power	
Pyrometer	
Pyroscope	
Relieving attachment for Lathe	
Sandblast Outfit, with cabinet	
Sand Sifter, for foundry, hand or power	
Scale	
Counter, for machine shop	
Platform, for foundry, 1000-lb. capacity	
Shaper	
Slotter	
Snap-Flask Jackets, to fit snap flasks used	
Straightening Press	
Surface Plates	
Swage Block and Stand, for forge shop	
Taper Attachment for Lathe	
Truck, warehouse	
Tumbling barrel, for the foundry	
Vises	
Blacksmith	
Drill press	
Machinist	
Pipe	
Planer	
Shaper	
Welding Outfit	
Acetylene	
Electric	

Metal Working—Small Tools

Name and Description	No.
Arbors	
Drill chuck to suit requirements	
Reamers, various sizes, each	
Shell tool, various sizes, each	
Straight shank for shell reamers and shell drills, selected sizes, each	
Taper shank for shell reamers and shell drills, selected sizes, each	
Bearing Scraper, sets	
Bellows, for foundry class	
Bevel Protractor	
Brooms and Floor Brushes, for shop and foundry	
Brushes	
Bench	
Core box	
Core painting	
Hard brushes for the foundry	
Soft brushes for the foundry	
Bulb Sponges, for molders	
Draw Pins, for molders	
Calipers	
Hermaphrodite, 4"	
Hermaphrodite, 6"	

(Continued on page 28A)

(Continued from page 27A)

Name and Description	No.	Name and Description	No.	Name and Description	No.
Inside, 4"		Flat bastard, 8" and 10", each		**Punches**	
Inside, 6"		Half-round, double cut, 6", 8", and 10", each		Center, ¼" and ⅜", each	
Outside, 4"		Hand, smooth, 8" and 10", each		Hollow, ½", ¾", and 1", each	
Outside, 6"		Mill, smooth, 8" and 10", each		Pin, ⅛", 3/16", 1/32", 5/32", and ¼", each	
Cans		Round bastard, 8"		Prick, ¼"	
Oil, ⅛-pt		Square bastard, 8"		**Rammers**	
Oil, 1-pt		Swiss, various shapes, each		Hand, for foundry	
Oil, 10-gal		Three-square, double cut, 6"		Floor, for foundry	
Waste		Warding, double cut, 6"		**Reamers**	
Center Testers		**First-Aid Cabinet and Supplies**		Adjustable, various sizes, each	
Chisels		**Forge Tools**		Hand, various sizes, each	
Cape, 3/16" and 5/16", each		Drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop.		Taper pin, various sizes, each	
Cold, 5/16" and ¾", each		**Gate Sticks**, maple, for foundry		With taper shank, various sizes, each	
Diamond point, ⅜" and ½", each		**Gauges**		**Riddles**, ¼" and ½" mesh, 18" diameter, for the foundry, each	
Round nose, ⅜" and ½", each		Center		**Rivet Sets**, assorted sizes, each	
Clamps, 4" and 6", each		Depth		**Scales**	
8" and 10", each		Drill and wire		Steel, 6", graduated 1/32" to ⅛"	
Flask, for the foundry		Screw pitch, select kinds, each		Steel, 12", graduated to 32nds	
Strap, various sizes, each		Surface		**Screw Drivers**	
Coke Forks, for foundry		**Gloves**, asbestos, for foundry		6" blade	
Collets		**Goggles**		9" blade	
For milling machine, selected sizes, each		For machine shop		**Scribers**	
For lathe, selected sizes, each		For foundry		**Shovels**	
Combination Squares, with hardened head and blade, and protractor head, 9" and 12", each		**Hack Saw**		Coke	
Counterbores, straight and tapered shanks, selected sizes, each		Blades, hand, 18T, 10", doz.		Sand	
Countersinks, for metal		Blades, power, 14T, 12", doz.		**Snips**	
Crucibles, of suitable sizes, each		Frames, adjustable		Straight, 3" cut	
Shanks, single, end to fit ladles		**Hammers**		Curved, 3" cut	
Shanks, hand, to fit ladle bowls		Babbitt		**Sockets**, for taper shanks, drill and tools, selected sizes, each	
Crucible Tongs, to fit crucibles, each		Ball-peen, 13-, 16-, or 20-oz.		**Soldering Coppers and Handles**, 1-lb. size	
Cutters		Blacksmith's, various kinds, each		**Spray Can**, for molders	
Angular-milling		Riveting, 9- and 12-oz., each		**Sprinkling Cans**, galvanized iron, 16-qt. capacity, for the foundry	
Bevel-gear		Setting		**Sprue Picks**, for molders	
Concave-milling		**Indicator**		**Squares**	
Convex-milling		Center		Machinists', 6"	
End-milling		Universal or universal dial test, each		Blacksmith's	
Face-milling		Speed		**Steel Figures**, ⅛", sets	
Formed-milling		**Knurling Tool**, with assorted knurls		**Steel Letters**, ⅛", sets	
Grooving		**Ladles**		**Swabs**, for molders	
Involute gear teeth		Bull		**Tapeline**, steel, 25'	
Key-seat		Hand bowls		**Taps and Dies**	
Side-milling		Melting		Machine Screws, sets	
Metal-slitting		**Lathe Dogs**, ½", ¾", 1", 1½", 2", 2½", and 3", each		Pipe, sets	
Dividers		**Leggings**, fireproofed duck, to protect students when pouring in the foundry, pairs		S.A.E. ¼" to ¾", sets	
Spring, 4"		**Level**, 6" bench		U.S.S. ¼" to ¾", sets	
Spring, 6"		**Lifting Screws**, for molders		**Tongs**	
Drill		**Mandrels**, selected sizes, each		Blacksmith's, various kinds, each	
Drifts, different sizes, each		**Mallets**, wood or soft face		Pick-up, for the foundry	
Drill sleeves, different sizes, each		**Micrometers**		Shake-out, for the foundry	
Stand for Nos. 1 to 60		Inside, 1½ to 8"		**Tool Holders**	
Stand for 1/16" to ½" by 64ths		Outside, 0" to 1"		Boring tools	
Drills		Outside, 1" to 2"		Cutting-off tools	
Center		Outside, 2" to 3"		Planer	
High-speed, taper shank, various sizes, each		**Molding Boards**		R.H. and L.H. offset shank	
Jobbers, straight shank, 1/16" to ½" by 64ths, each		**Molding Sticks and Trowels**, various kinds, each		Shaper	
Ratchet		**Nippers**, end-cutting, 5"		Slotter	
Straight-shank, Nos. 1 to 60, each		**Oilstones**, medium and fine, each		Straight shank	
Taper shank, ½" to 1" by 16ths, each		**Oil Storage Tank**, with pump		Threading	
Emery		**Pails**, galvanized, 12-qt. capacity for the foundry		**Tool-Holder Bits**, square, ¼", 1/16", 5/32", 3/16", ½"	
Rub-stones for cleaning castings in the foundry		**Parallels**		**Trammel Points**, sets	
File Card		Adjustable		**V Blocks and Clamps**, pairs	
Files		Steel, assorted sizes, each		**Wheel Dresser**	
Die sinkers, various shapes, each		**Pliers**		**Wrenches**	
		Combination, 6"		Adjustable, 8" and 10", each	
		Side-cutting, 6"		Pipe, 8" and 12", each	
				Tap, adjustable, various sizes, each	

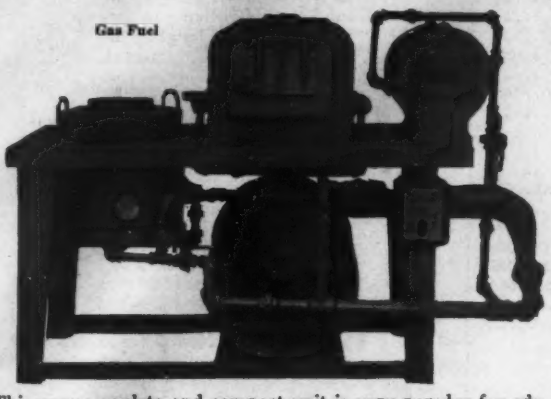
(Continued on page 30A)

FURNACES STEWART FORGES

The furnaces and combinations here shown are just several of a variety designed and developed for the school shop.

Stewart Triple Purpose Furnace

Gas Fuel



This very complete and compact unit is very popular for educational purposes and the toolroom—an assembly of three of our standard Stewart Furnaces making a complete, compact plant covering practically the whole range of the heat treatment of metals on a small scale.

Crucible section for lead, cyanide, or salt hardening fitted with 6" x 12" pressed steel pot. Interchangeable to accommodate a No. 12 graphite crucible for metal melting.

Oven section for general heat treating of carbon or high speed steels.

High speed section for tool dressing, rod end work, and forging.

The illustration above shows a Turbo Blower mounted below the table with push button starter.

A very complete and space-saving unit. Can be furnished in other combinations.

No. 4A Bench Metal Melting Furnace

This melter is fitted with a No. 4 Graphite crucible, lined with heavy firebrick and fitted with a swinging cover for the melting of brass, copper, and aluminum. Assures fast, quick heats.

Gas Fuel

Height .....19"
Bench space .....20" x 24"
Shipping weight .....180 lbs.

No. B68 Round Pot Furnace

This bench type unit is equipped with a pressed steel pot, 6" in diameter and 8" deep, for lead, cyanide, or salt hardening. Can also be used for oil tempering. Lined with heavy refractories and fired so that no flame strikes the pot direct.

Gas Fuel

Height .....19"
Bench space .....20" x 24"
Shipping weight .....170 lbs.

No. 152 Forge—Ideal for Small Work

This unit is very handy and one that can be placed conveniently on a bench or small table for the heating of small pieces to be forged, for the heating of rods for bending, for tool dressing, and for the taking of end heats. It has a small opening at both ends so that center heats can be taken or it can be worked from both ends. Ideal where a quick intense heat is required. The top is removable to handle a wide variety of work.

Entrance .....1¼" x 1¼"
Bench space .....12" x 12"
Overall height .....15"
Shipping weight .....60 lbs.

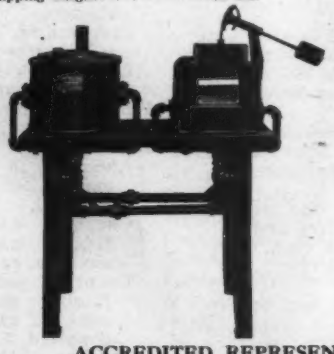
SK 248 Forge

A sturdy, well built forge designed for tool dressing, rod end work, heating for bending, welding, the taking of center heats, and many other purposes where a fast high heat is required. Welding temperature secured in 20 minutes. Fitted with air curtain in front to protect the operator and equipped with a proportional gas and air mixer and a quenching tank with rack for tongs.

Opening .....4" wide x 2" high
Heating depth .....8"
Rear opening .....3" diameter
Shipping weight .....450 lbs.

Two Purpose Furnace

The Unit on the left is used for cyanide hardening, lead hardening, or other liquid heat for hardening. It can be used for melting soft metals. It is fitted with a pressed steel pot 6" diameter x 6" deep or 6" diameter x 8" deep.



Specifications

Gas connection .....1"
Air connection .....1"
Floor space .....48" x 18"
Shipping weight...500 lbs.

ACCREDITED REPRESENTATIVES AND DEALERS

J. W. LAZEAR
11 West 42nd St.,
New York City, N. Y.

C. M. BIGGER CO.
714 Transportation Bldg.,
4th and Sycamore Sts.,
Cincinnati, Ohio

R. C. SPERRY
604 Chamber of Commerce Bldg.,
Pittsburgh, Penna.

P. R. GRAM
808 W. Mt. Hope Ave.,
Lansing, Mich.

R. C. JORDAN
c/o Chicago Flexible Shaft Co.,
18th St. and Indiana Ave.,
Philadelphia, Penna.

HENRY G. HOSS
4801 Park Ave.,
Indianapolis, Ind

J. W. BLACK
19 Sidney St.,
East Haven, Conn.

H. F. FETZER
1926 Melrose St.,
Rockford, Ill.

WESSENDORF, NELMS AND CO.
317 Preston Ave.,
Houston, Texas

SIDNEY J. PFAFF
1949 University Ave.,
St. Paul, Minn.

PAUL SLADKY
3906 No. 19th St.,
Milwaukee, Wis.

EICHMAN MACHINERY CO.
Manufacturers Exchange Bldg.,
210 W. 8th St.,
Kansas City, Mo.

HAUSER SUPPLY CO.
3117½ Washington Blvd.,
St. Louis, Mo.

Also
FLEXIBLE SHAFT CO., LTD.
349 Carlaw Ave.,
Toronto, Ont., Canada.

For complete specifications and catalogs, write

Chicago Flexible Shaft Company

5529 W. Roosevelt Road, Chicago, Illinois

(Continued from page 28A)

Metal Working—Materials and Supplies

Name and Description	No.
Abrasive Wheels	
Acetylene Gas, in drums, for welding	
Aluminum Pigs, for foundry	
Babbitt Metal	
Bearing Blue, tubes	
Belt Dressing	
Belt Lacing Material	
Belt Leather	
Bolts	
Carriage, selected sizes, lots of 100 each	
Lag, selected sizes, lots of 100 each	
Machine, selected sizes, lots of 100 each	
S.A.E., selected sizes, lots of 100 each	
Stove, flat or round heads, selected sizes, in lots of 100 each	
Brass	
Bars, 1/8", 1/4", 3/8", and 1/4" thick; 3/4" to 1" wide, 8' to 10' long, selected sizes, each	
Round Rods, 1/8" to 1/2" by 16ths, selected sizes, feet each	
Sheets, 28 to 32 American gauge, 12" wide by 72" to 84" long, selected sizes, sheets, each	
Strips, 1/32" and 1/16" thick, 1/2" to 1 1/2" wide, 50 ft. to a coil, selected sizes, coils each	
Threaded Rods, Nos. 6 to 10, come in 12" lengths. Nos. 12, 14, 1/4", and 5/16" come in 24" lengths, selected sizes, rods	
Wire, soft, 8, 11, and 14 American gauge, selected sizes, lb.	
Wire, spring, 8 to 22 American gauge, selected sizes, lb.	
Casehardening Compounds	
Chaplets, single and double head	
Coal	
Charcoal for foundry or forge	
Coke for foundry	
Forge	
Copper	
Pigs, for casting alloys	
Sheets, 8 to 25 American gauge. Size of sheets, 30" x 60". Selected sizes, sheets, each	
Tubing, outside diameters, 1/8", 1/4", 3/8", 1/2", 5/8", 3/4", thickness of wall, 1/32", lengths, 8' to 12'. Selected sizes, lengths each	
Wire, soft, 2 to 20 American gauge, in coils. Also obtainable in 1/4-, 1/2-, and 1-lb. spools, in sizes 16 to 36 English gauge. Selected sizes, pounds each	
Core	
Compounds	
Flour	
Paste	
Oil	
Wax-vent wire	
Cutting Compounds	
Emery Paper and Cloth	
Nos. 00, 0, 1/2, 1, obtainable in sheets or rolls. Selected sizes. If in sheets, quires each	
In rolls, rolls each	
File Handles, assorted sizes, each	
Fire Bricks and Clay, for foundry	
Graphite, for foundry	
Iron	
Pig, for foundry	
Lacquer, transparent and colored, for finishing	
Nuts	
S.A.E., acorn cap, castellated, square, hexagon, joint, and wing. Selected sizes and kinds. Lots of 100 each	
Oil	
Boiled linseed, gal.	
Lubricating, gal.	
Quenching and hardening	
Packing	
Round, sheet, square, or tubular	
Paint, black asphaltum	
Pins	
Cotter, 1/16" to 1/4" diam. from 1/2" to 2" long. Obtainable in boxes containing an assortment of 120 cotters	
Flask, for flask repairs	
Taper, Nos. 0 to 6, 3/4" to 2" long. Obtainable in boxes containing 40 assorted pins	
Pumice Powder	
Rivets	
Copper, with burrs, Nos. 7 to 14, lengths, 3/8" to 3/4". Selected sizes, 1/2-lb. boxes, each	
Iron, No. 14 gauge to 1/4". flat-head or button-head. 1/4" to 1" long. Selected sizes, lb. each	
Tinners, flat-head, 8-oz. to 16-lb., either tinned or black. Selected sizes, lb. each	
Sand	
Molding, can be had in 350-lb. barrels or 800-lb. casks.	
Parting, can be had in 350-lb. barrels or 800-lb. casks	
Screws	
Flat-head or round-head, iron or brass. Selected sizes and kinds, per hundred, each	
Cap and machine, iron or brass. Selected sizes and kinds, per hundred, each	
Set, head and headless	
Solder	
Acid or rosin core; bar, or solid wire	
Soldering Paste or Salts	
Steel	
Bessemer, rod, 1/4" to 3/8" by 64ths, in 4' lengths. Selected sizes, lengths, each.	
Bars, cold-rolled, 1/8" to 3/4" thick, 1/2" to 2" wide, 12' lengths. Selected sizes, lengths, each	
Drill rod, letter sizes, A to Z; number sizes, 1 to 80. Comes in 3' lengths. Selected sizes, lengths, each.	
Rods, hexagon and square, cold-rolled, 1/4" to 3/4". Comes in 12' lengths. Selected sizes, lengths, each.	
Round, cold-rolled, diameters 1/8" to 1", lengths 12'. Selected sizes, lengths, each	
Sheet, black, Nos. 18, 20, 22, 24, 26, 28 U.S. gauge; size of sheets, 24", 28", and 30"x 96". From 4 to 13 sheets in a bundle. Selected sizes, bundles, each.	
Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24", 28", and 30"x 96". From 4 to 12 sheets in a bundle. Selected sizes, bundles, each	
Threaded rods, Nos. 6 to 10. Come in 12" lengths. Nos. 12, 14, 1/4", and 5/16". Come in 24" lengths. Selected sizes, rods each	
Tin	
Pigs, for casting alloys	
1C, 1X, 20"x 48", 112 sheets to the box	
1XX, 20"x 48", 56 sheets to the box	
Washers and Burrs	
Copper, burrs, Nos. 3 to 14, in 1-lb. boxes	
Iron burrs, Nos. 3 to 14, in 1-lb. boxes	
Brass washers, 1/8" to 1/2" by 16ths	
Iron washers, 1/8" to 1/2" by 16ths	
Welding Fluxes	
Welding Rods, all rods come in 24" lengths	
Brazing, 1/16", 1/8", and 3/16" diameter	
Cast aluminum, 1/16", 1/8", and 3/16" diameter	
Cast brass, 1/16", and 1/8" diameter	
Cast bronze, 1/8" diameter	
Cast copper, 1/16" and 1/8" diameter	
Cast iron, 1/16", 1/8", 3/16", and 1/4" diameter	
Low carbon steel, 1/16", 3/32", and 1/8" diameter	
White Lead, for machine shop, lb.	
Wire	
Annealed, 16 to 34 English gauge. Selected sizes, lb. each	
Coppered market, 5 to 18 English gauge. Selected sizes, lb. each	
Coppered spring, 2 to 18 English gauge. Selected sizes, lb. each	
Galvanized, 5 to 18 English gauge. Selected sizes, lb. each	
Piano, 00 to 36. Selected sizes, lb.	
Tinned, 16 to 24 English gauge. Selected sizes, lb. each	
Wool, No. 0 to 3 in pound packages. Selected sizes, lb. each	
Zinc	
Pigs, for casting alloys	
Sheet, Nos. 4 to 14. Sheets 36"x 84"	

(Continued on page 33A)

ADVERTISING PAGES REMOVED

Automotive Equipment, Tools, and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.	Name and Description	No.
Air Compressor		*Creepers*	
3 to 4 cu. ft., with tank, piping, and motor		*Desk with Chair*	
Small portable, 1 cu. ft., with motor		*Drill*	
Aligning Jig, for connecting rods		Breast	
Anvil		Hand	
No. 100 or No. 125		Electric portable, ½-in.	
Rim		Electric portable, ¼-in.	
Armature Growler and Tester		Press, 21-in., with motor and chuck	
Axle Stands		*Dynamometer*, electric	
Battery Equipment		*Forge*, with blower and tools	
Cell tester, panel type with discharge rack		*Furnaces*, gas	
Charger (15-battery size) with rack		*Grease Dispensers*	
Charger (6-battery size)		*Grinder*	
Gas stove (small)		Cylinder with motor	
Lead-burning torches, with gauges and piping		8-in., with motor	
Plate racks		12-in., with motor	
Bench		*Hones*, cylinder	
Electric test, elaborate		*Jacks*	
Electric test, simple		Lever, 1½ ton	
Work, with vises		Floor, roller	
Work, portable with vise		*Lathe*	
Blackboard		11 in. by 4 ft. with motor, chucks, and attachments	
Blowtorches, 1 quart		16 in. by 6 ft. with motor, chucks, and attachments	
Bookcase		*Press*	
Brake		*Arbor*	
Adjusting stand		30 ton	
Band-lining machine		*Spray Painting Outfit*	
Bulletin Board		*Valve Refacing Machine*	
Cabinets		*Vulcanizer*	
Wood or metal, for bolts and supplies		Electric steam for tube work	
Wood or metal, for filing job sheets and correspondence		Small, hand	
Chain Hoist, with overhead trolley and track		*Welding Outfit*, with tanks, gauges, and cutting torch	
Chairs with Tablet Arms, or chairs for tables		*Wheel Alignment*	
Crane, portable		Gauge	
Crankshaft Truing Tool		Test table	

Small Tools

Name and Description	No.	Name and Description	No.	Name and Description	No.
Alcohol Tester		1-gal. gas safety		*Floor Brushes*, 18 in.	
Battery		5-gal. gas safety		*Funnels*, tin, assorted sizes	
Cell tester, prod type		5-gal. kerosene		*Gauges*	
Cell tester, cadmium		Waste can		Air pressure	
Clips, large		*Checks*, tool, 1,000 blank		Center	
Element pullers		*Chisels*		Depth	
Fillers		Cape, 3/8- and 5/8-in., each		Thread	
Funnels, glass		Cold, 3/8-, 5/8-, ¾-, 1-in., each		Thickness	
Hydrometer, acid		Diamond point each		*Glass Cutters*	
Knives		*Combination Squares*, 12 in.		*Goggles*	
Post builders		*Cotter-Pin Extractor*		*Grease Guns*, plain and pressure-type, each	
Post drills		*Dividers*, 6 and 10 in., each		*Hammers*	
Post reamers		*Drill Sets*		Ball-peen, 4-oz.	
Post markers		1/32 to ½ in. by 64ths		Ball-peen, 1¼-lb.	
Separator trimmer		½ to 1¼ in. by 32nds		Ball-peen, 2-lb.	
Bits		*File Cards*		Lead	
Expansive		*File Handles*, assorted		Riveting	
Ratchet brace		*Files*		Sledge, No. 12	
Wood, 3/16 to 1 in., sets		Flat bastard, 6, 8, 10, and 12 in., each		*Ladle*	
Bolt Cutter		Half round, 6, 8, 10, and 12 in., each		3-in. bowl	
24 in.		Mill, 6, 8, 10, and 12 in., each		6-in. bowl	
36 in.		Round, 6, 8, 10, and 12 in., each		*Lamps*, extension, with reels	
Calipers		Square, 8, 10, and 12 in., each		*Lead Pot*, gas	
6 in., inside		*Fire Extinguishers*, Pyrene and Acid		*Magnet Charger*	
6 in., outside		*First-Aid Cabinet and Supplies*		*Meters*, volt and ammeter test, each	
Cans					
Oil, 1/3 pint					

(Continued on page 36A)

SNAP-ON TOOLS, INC.

Snap-on TRADE MARK
INTERCHANGEABLE
Socket Wrenches

An organization of tool specialists maintaining a nation-wide personal tool service through permanent branch offices operated on a local tax-paying basis and managed by local residents of the community. Ceaseless experimental work has enabled us to constantly offer new and improved tools to assist mechanics and improve shop work efficiency on the rapidly-changing designs of modern automobiles.

Blue-Point TRADE MARK
Mechanic Tools

Snap-On Socket Wrenches not only are used and recommended by a large majority of auto mechanics, but they are used on the assembly lines of most of the modern car manufacturers. The line provides a full range of dependable sockets in all hexagon and square sizes at a low cost per wrench.

Blue-Point Tools are built for practical, everyday use by professional mechanics and their widespread popularity in industry is the highest possible recommendation for them. In addition to standard Boxocket, Open End, Tappet Wrenches, etc., this line covers many special tools for auto repair work.

8 Snap-On Wrenches as illustrated, in metal case.....$5.30
Special School Price when sold in lots of six or more sets for educational purposes only. Per Set.....$4.00

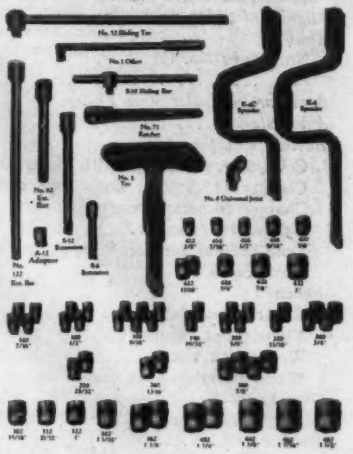
The Student School Shop Set

Every school pupil requires his own text book—it would be most impractical for an entire class to attempt to study in turn from two or three copies. Each student of Drafting likewise needs certain individual drawing instruments for efficient work. Similarly, it is just as important that each student in the auto mechanics shop be equipped with an individual set of the most basic and essential wrenches. This need is recognized by School Shop Instructors who have approved the Snap-On Student Set of matched units as solving an otherwise perplexing and costly problem. In many cases the student prefers to own this personal set, consisting of a combination Sliding Tee and Offset Handle, an Extension Bar and the six most needed sizes of Sockets.

School Shop Toolroom Assortment

A popular combination of matched units carefully selected as forming the socket wrench equipment of greatest service in the average school auto mechanics shop. The seventy-seven units offer an almost unlimited number of wrench combinations for every type of hook-up needed.

Units in greatest demand are duplicated according to the need, a most desirable feature where tools are checked in and out of the toolroom and the largest possible number of working combinations are wanted at one time. Please note that while we recommend this set for the average shop, we will make up special selections to suit any particular requirements.



77 Snap-On Wrenches as illustrated, with total price.....$57.80
Special School Price (when sold as a set) for educational purposes only.....$43.35

Popular Snap-On and Blue-Point units needed in every shop

No. 80 Ferret Set

Seven Double Hexagon Sockets 3/8" to 3/4", a Reversible Ratchet Handle, Speeder Tee, Sliding Bar, Universal Joint and three Extension Bars. Extremely strong though slender units that make quick, easy work of nuts in hidden or cramped places on all modern automobiles.

No. 56 Midget Set

Eight Hexagon Sockets 3/16" to 7/16", two Square Sockets 1/4" and 5/16", Ratchet, Speeder Tee, Sliding Tee, Ext., Bar and Insulated Handle. Excellent for electrical, carbureter, radio and other small work.

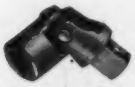
Set Contains 13 Tool

No. 25-C Nut Spinner Set

Handle provides an Offset, long Speeder Tee or Ell Wrench. End of handle broached with 1/2" square for Ratchet or Sliding Bar attachment. Twelve straight-walled double hexagon sockets 7/16" to 1" sizes. Covers more jobs for its size than any other socket set made.

Straight-Walled Sockets

SW-1200 Set of Extra Thin, Straight-Walled Sockets. Double Hexagon. 7/16" to 1" openings. Close-quarter nut turning capacity makes them the most popular type of sockets with garage mechanics everywhere.



No. 8 Universal Joint. Slender, Compact. Works freely at 90° angle. Fits all Master 1/2" drive units.

Master 1/2" drive Flex Sockets, made in five popular sizes. Note straight walled design for close corner work.

A-50 Stud Remover. Operates on a gear principle and develops tremendous gripping power, yet releases the stud quickly and easily.

No. 71-A Reversible Ratchet

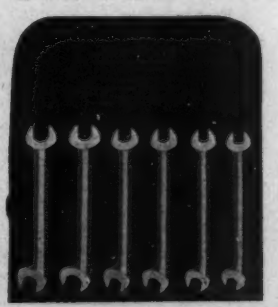
Ratchet action reverses instantly by moving a convenient thumb lever. Designed to be the strongest and most practical tool of its kind and size ever built. Twenty teeth on ratchet gear provides turning action in the closest quarters with only a slight handle movement. Wheel and pawl accurately machined from finest high-carbon alloy tool steel.

Dual Ratchet Wrenches

A different sized opening on each end. Handy for manifold nuts, body bolts, etc. Strongly constructed and with very free working ratchet action.

Open End Wrenches

BPR-8 Set Blue-Point "Supremes." Five outstanding improvements:—Thinner head design—Narrower jaws for close corners—Lighter Weight—Better, tougher steel — Distinctive modern design and finish. 3/8" to 7/8" sizes.

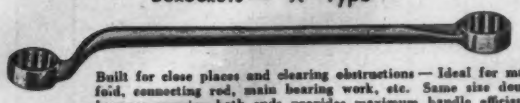


Tappet Wrenches

Scientific and balanced design, better steel, lighter weight and thinner heads. A new development that puts Blue-Point "Supreme" Tappet Wrenches in a class by themselves. Built for professional work, they embody every advanced feature in construction, material and workmanship. BT-8 Set, 7/16" to 7/8" sizes.

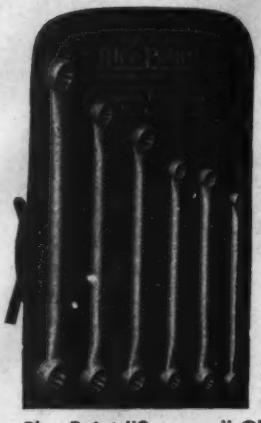
Snap-On Tools, Inc.—Continued

Boxockets — "X" Type

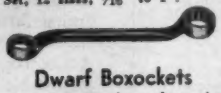


Built for close places and clearing obstructions — Ideal for manifold, connecting rod, main bearing work, etc. Same size double hexagon opening both ends provides maximum handle efficiency.

"XD" Type



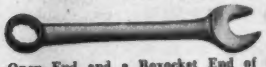
Straight-handle Boxocket Wrenches with heads set at a 15° angle — provides obstruction clearance and retains long leverage and direct pulling power. Different size each end. XD-6 Set, 12 sizes, 7/16" to 1".



Dwarf Boxockets

Each end offset to clear obstructions and two sizes on each handle. Made in several popular and needed sizes. Handy for carbureter, universal joint, generator, manifold work and other close quarter jobs.

Combination Type



An Open End and a Boxocket End of the same size on each wrench. Made in two styles—long handle and short handle, and in the most popular sizes.

Blue-Point "Supreme" Chisels and Punches

Professional use demands a chisel that will cut bolts, cast iron and steel without damage to the cutting edge, yet tough enough for use as a wedge or lever. Blue-Point "Supreme" Steel contains these and other properties not found in other makes of Chisels or Punches. Above all, the danger of flying chips is entirely eliminated. See catalog for various types and sizes.

Hammers and Screw Drivers

A quality line of Ball Pein Hammers, correctly designed and balanced, with handles of selected seasoned hickory. Heads securely anchored. Made in 12 sizes.

Blue-Point "Insuloid" Screw Driver shown is one of the most popular units. Blade designed to withstand hardest service—handle insulated composition. See catalog for descriptions of this and other types.

Vacuum Grip Pliers

Famous among mechanics for their high quality, strength and durability. Cut at left shows No. 137 Heavy Duty General Use Plier and No. 196 Needle Nose Plier. No. 9 Packing Nut Wrench shown above turns any shaped nut, rod, bolt, etc. Grips like a pipe wrench. Many other plier types shown in catalog.

Bolt Cutter and Nut Splitter

Cutting power exceeds that of any other bolt cutter of similar size on the market. Handles hammer forged—will not bend or snap. Four types of Cutting Blades and a Nut Splitter Blade interchangeable on one handle.

Ford, Chevy and Buick Tools

Special purpose tools designed to simplify difficult jobs on these cars are too numerous to describe here — write for catalog.

Valve Grinder

Sturdily built and smooth in operation. Machined gears. Rapid oscillating motion. A real tool for long hard service.

No. 310 Feeler Gauge
Finest Swedish Steel

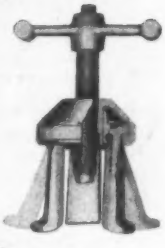
Stronger, slim adjustable jaws for all types of motors. Cam lock holds spring compressed. Easy to use—simple to adjust.

Blue-Point Wire Brushes

Made to outlast any similar tool on the market. High quality selected crimped wire, metal bound to prevent bending and dangerous chips from breaking loose. Hand brush fitted with scraper blade, replaceable head.

Wheel and Gear Pullers

No. 4567 Universal Stud Bolt Type Wheel Puller—fits all stud bolt circles on passenger cars and on many truck models. Simply move the jaws to the correct position and attach the bolts. Other types available for Threaded or Grooved Hubs. See our catalog.



Blue Point Gear Pullers, Bearing Race Pullers and Universal Puller Tools are essential units in every shop. Take all bearings and races, pinion and axle shafts, timing gears, bushings, grease retainers, flanges, etc. Full descriptions in our general catalog.

Tool Budget Plan

With the information obtained through a careful survey of school shop requirements we have prepared fourteen distinct Tool Lists or Budgets ranging in price from $25.00 to $250.00 and containing the most useful selection of tools obtainable for any given amount of money. These Budgets, however, are simply suggested sets for average shops and we are glad to make up special selections to suit particular shop requirements.

A representative from our nearest branch office would be glad to assist you in making such selection and to give you complete information regarding the Snap-On School Shop Budget Plan and special discounts. There is no obligation on your part and we invite you to ask for this helpful, friendly service.

Write for this New Catalog

Space here only allows us to show a small number of the standard and none of the special tools in the Snap-On and Blue-Point lines. There are literally hundreds of other dependable, high quality units, just as important, illustrated and fully described in our regular catalog, a copy of which we are anxious to send you together with detailed Budgets. It places you under no obligation and we suggest you write for them immediately.

Genuine Snap-On Wrenches and Blue-Point Tools, can be purchased only through our own Sales Branches listed. Advise your Purchasing Department accordingly.

Albany, N. Y. ..... 102 Quail St.
Atlanta, Ga. ..... 10 North Ave., N.W.,
Baltimore, Md. ..... 2218 Greenmount Ave.
Boston, Mass. ..... 510 Cambridge St., Allston Dist.
Brooklyn, N. Y. ..... 1649 Bedford Ave.
Buffalo, N. Y. ..... 193 Utica St.
Chicago, Ill. ..... 2025 MichiganBlvd.
Cincinnati, Ohio. ..... 1120 Race St.
Cleveland, Ohio. ..... 2438 Euclid Ave.
Columbus, Ohio. ..... 107 N. Monroe Ave.
Dallas, Texas. ..... 2809–11 Main St.
Denver, Colo. ..... 17 E. Fourth Ave.
Detroit, Mich. ..... 4450 John "R" St.
Indianapolis, Ind. ..... 933 N. Illinois St.
Jacksonville, Fla. ..... 119 W. Ashley St.
Kansas City, Mo. ..... 2516 Grand Ave.
Los Angeles, Calif. ..... 1845 S. Flower St.
Milwaukee, Wis. ..... 2417 W. State St.
Minneapolis, Minn. ..... 1218 Harmon Place
Montreal, Que. ..... 1008 La Gauchetiere St., W.
Newark, N. J. ..... 429 Central Ave.
New York, N. Y. ..... 7 Lenox Ave.
Omaha, Neb. ..... 2041 Harney St.
Philadelphia, Pa. ..... 1705 Fairmount Ave.
Pittsburgh, Pa. ..... 7250 Kelly Blvd.
Richmond, Va. ..... 606 W. Broad St.
San Francisco, Calif. ..... 276 Golden Gate Ave.
Seattle, Wash. ..... 110 Broadway, N.
St. Louis, Mo. ..... 2647 Washington Blvd.
Syracuse, N. Y. ..... 111 W. Taylor St.
Toledo, Ohio. ..... 1012 Jackson St.
Toronto, Ont. ..... 54 Dundas St., West
Vancouver, B. C. ..... 1152 Howe St.

Export Department, Snap-On Tools, Inc.,
59-61 Pearl St., New York, N. Y.

SNAP-ON TOOLS - -

Factory and Main Office
KENOSHA, WISCONSIN

(Continued from page 33A)

Name and Description	*No.*	*Name and Description*	No.	*Name and Description*	No.
Micrometers		Taper pin		*Tap-and-Die Sets*	
Outside, 0 to 1 in.		Valve seat, sets		Machine screw	
Outside, 2 to 3 in.		*Saws*		S.A.E. ¼ to 1 in.	
Outside, 3 to 4 in.		Hack, frames, 10-in., adjustable		U.S.S. ¼ to 1 in.	
Inside, 1½ to 6 in.		Hack-saw blades, 18-, 20-, and 24-teeth		*Tire Tools*, sets	
Molds		Hand		*Tool Kit*, metal box or canvas roll, empty	
Battery nut		*Scales*		*Twist Drills* (extra sets), selected sizes	
Battery post		Steel, 6-in., graduated 1/64 and 1/100 in.		*Valve*	
Battery strap		Steel, 12 in., graduated 1/32 in.		Grinders (hand)	
Burning stick		*Scrapers*		Spring lifters	
Lead hammer		Bearing, sets		*Wrenches*	
Oilstone		Carbon, sets		Adjustable, 18-in.	
Pipe Taps, ⅛, ¼, ⅜, and ½ in.		*Screw Drivers*		Adjustable, 12-in.	
Pliers		6 in.		Adjustable, 10-in.	
Combination, 6 in.		12 in.		Adjustable, 8-in.	
Flat nose		Small Combination		Ignition sets	
Round nose		*Screw Extractors*, sets		Pipe, 10-, 14-, 16-, and 18-in., each	
Pullers		*Scribers*		Rim socket	
Bearing		*Snips*, tin, 3-in. straight and 3-in. curved, each		Socket sets, large assortment with case	
Gear		*Soldering Coppers*, 1-, 2-, and 3-lb. with handles, sets		Spark plug	
Wheel, hub type		*Spring Spreaders*		Speed wrenches	
Punches		*Stamps*		Standard end sets, ¼ in. to ⅞ in., U.S.S. and S.A.E.	
Center (sets)		Figures, 3/16-in., set		Valve-tappet wrenches, sets	
Taper pin (sets)		Letters, 3/16-in., set			
Blacksmith (sets)					
Putty Knives					
Reamer, spindle bolt					
Reamer Sets					
Piston pin, ½ to 1⅛ in.					

Supplies

Name and Description	No.	*Name and Description*	No.
Acetylene Gas, in drums, for welding		Machine-screw, selected sizes, in lots of 100 each	
Acid		Wing, selected sizes, in lots of 100 each	
Alcohol, gal.		*Oil*	
Babbitt, lb.		Cylinder, light, medium, and heavy	
Bearing Blue, tubes		600W	
Bearing Compound, cans		Penetrating, pints	
Bolts		*Oxygen* in drums for lead burning	
Machine, selected sizes, lots of 100 each		*Pig Lead*, lb.	
S.A.E., selected sizes, lots of 100 each		*Piston-Ring Compressors*	
Stove, flat or round heads, selected sizes, in lots of 100 each		*Radiator Hose*	
Brake Juice, ½-pt. cans		*Rivets*, brake-lining, 5/16, ½, and ¾ in. long. Boxes of 100, each	
Brushes		*Sandpaper*, Nos. 00, 0, ½, and 1, quires each	
Paint		*Screws*	
Spark-plug		Flat-head or round-head, iron or brass. Selected sizes and kinds, per gross, each	
Spoke		Cap and machine, iron or brass. Selected sizes and kinds, lots of 100 each	
Steel		*Sealing Compound*	
Varnish		*Shellac*, ½-pt. cans	
Chamois		*Shim Stock*	
Coil-Spring Assortment		*Soapstone*, lb.	
Copper Tubing		*Solder*, bar, wire, or self-fluxing wire	
Cotter Pins, assorted sizes, pkgs.		*Soldering Paste*	
Crocus Cloth, quires		*Spelter*, for brazing, lb.	
Distilled Water, gal.		*Sponges*, ½-lb. each	
Drain Cocks		*Starting Cable*, ft.	
Electrolyte, carboy		*Tacks and Staples*, for upholstery	
Emery Cloth, Nos. 00, 0, ½, and 1, quires each		*Tire*	
Enamel for Auto Painting		Carcass fabric	
Gaskets		Cushion stock	
Copper asbestos		Inner-tube repair stock	
Cork and felt		Patching cement	
Flange		Patches	
Gasoline		Putty	
Grease, cup, cans		Tread stock	
Kerosene		Vulcanizing	
Keys, Whitney, assorted		*Valve-Grinding Compound*, coarse and fine, 8-oz. cans	
Lacquer, colors, qt.		*Washers*	
Lead		Lock, assorted sizes	
Lubricant, transmission		Wrought iron	
Nails and Brads		*Waste*, lb.	
Nuts		*Wire*	
S.A.E., castellated, square, hexagon. Selected sizes and kinds, lots of 100 each		Primary, ft.	
U.S.S., square and hexagon. Selected sizes, lots of 100 each		Secondary, ft.	

Drafting Equipment and Supplies

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.	Name and Description	No.	Name and Description	No.
Adjustable-Curve Ruler		**Drawing-Board Supports, to be set on or attached to wood-worker's bench**		**Steel Scales, 12"**.....	
Beam Compass		**Drawing Tables and Stools**		**Stop Watch, for mechanical-drafting students**.....	
Bench Brushes		For students.....		**Table**	
Blackboards		For teacher.....		For cutting and trimming drawings and blue prints.	
Compass, 15", with locking device		**Ink-Bottle Holder**.....		For disassembling and reassembling machine parts and models	
Drawing set: T square straightedge, triangle, and protractor		**Irregular Curves**, Nos. 17, 21, and 24, wood, rubber, or transparent, each		**Tapeline**	
Permanent or portable.....		**Lettering Angles**		100' steel, for architectural students	
Blue-Print		**Lettering Pens**, assortment of 12		50', steel or metallic.....	
Frame or machine.....		**Level or Transit, builders', for architectural students**		**Tool Box**, containing 1 machinist's hammer, one 6" adjustable wrench, one 6" screw driver, one pr. 6" combination pliers	
Washing trays or washer...		**Leveling Rod, for use with the transit**		**Triangles**	
Paper tube, air-tight.....		**Machinists' Combination Set, 12"**		30-60-deg. 14" transparent...	
Drying Rack or Dryer.....		**Marking Pins, for use with measuring tape, for architectural students**.....		45-deg. 10" transparent.....	
Bookcase, for reference library		**Micrometer, 1", for mechanical-drafting students**		**Triangular Scales, civil engineers' type, 12"**.....	
Cabinet		**Oilstone, 3" case**.....		**T Square**	
For filing drawings.....		**Pantograph, 21"**.....		Adjustable or fixed head, for large drawing board, or straightedge with parallel rule attachment for large drawing boards.....	
For storing drawing boards.		**Parallel Rules**.....		**Wall Charts, lettering, decimal equivalents, etc., each**.....	
For storing drawing instruments		**Planimeters**.		**Yardstick**	
For storing models.....		**Plumb Bob**			
Calipers		**Shears, for trimming blue prints and drawings**.....			
6" inside and outside, each..		**Speed Counter, for mechanical-drafting students**			
8" inside and outside, each..					
Desk					
Teacher's					
Chair to match.....					
Dividers, proportional.....					
Drafting machine and accessories					
Draftsman's Steel Protractor..					
Drawing Boards, large.....					

Drafting—Small Equipment

To be provided by, or for, each student

Drawing Board, size to be specified by the instructor..		**Pencil Compass**		**Slide Rule, 10", as specified by the instructor**.....	
Drawing Instruments, as specified by the instructor, sets..		**Penholder, for lettering pens**..		**T Square, to fit drawing board**	
Erasing Shield		**Pens, assorted, for lettering**...		**Triangles**	
Irregular Curve, Nos. 8 and 13, transparent, each		**Protractor, not over 5"**.....		30—60-deg., 10" transparent.	
		Scale, 12" architect's, triangular		45-deg., 8" transparent.....	
		Scale Guard.....			

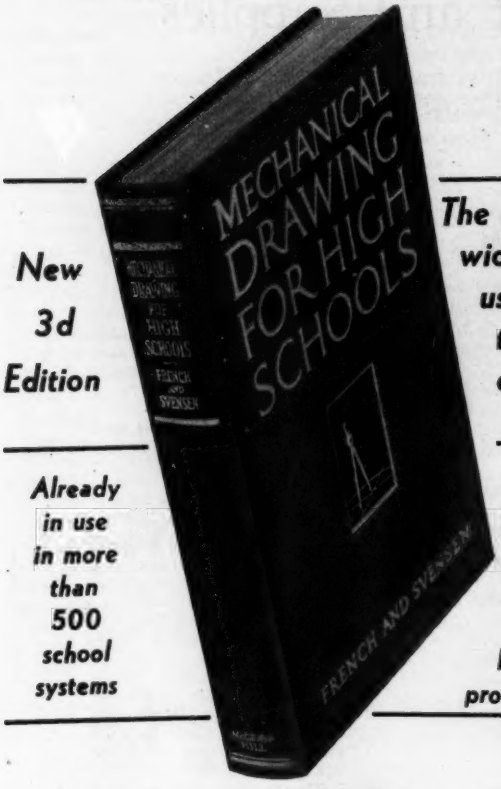
Drafting Supplies

Bichromate of Potash, crystals, lb.		Cross-section, 8½"x11", reams		**Powder, for tracing cloth, cans**	
Blue-Print		Detail, 24"x36", reams.....		**Tracing Cloth, 36", yd**.....	
Paper, 36" wide, yd.....		Drawing, 24"x36", reams....		**Van Dyke**	
Writing fluid, bottles.....		Isometric, 7"x10", sheets....		Fixing salts, 4-oz. cans.....	
Paper		Tracing, 36", yd.....		Paper, 36", yd.....	
				Writing fluid, 2-oz. bottles..	

Drafting—Additional Supplies

To be provided by, or for, each student

Erasers		**Ink**		**Pencils, drawing, HB, 2H, 3H, 4H, and 6H, each**.....	
Cleaning		Black, waterproof, ¾-oz., bottles		**Pencil-Pointer Pad**.....	
Ink		Colored, if required, ¾-oz., bottles of each color.....		**Thumb Tacks**	
Pencil					



New 3d Edition

The most widely used text of its kind

Already in use in more than 500 school systems

New data

New problems

French and Svensen's

MECHANICAL DRAWING

for High Schools

A text with problem layouts

$1.50

A complete textbook and a complete problem book for a two-year course in one volume.

Chapters shortened into workable classroom units.

Represents in textbook form the best pedagogy, the best methods of progressive teachers in the field.

Please keep in mind also French and Turnbull's *Lessons in Lettering*, Books I and II, $3.60 per doz.

ON-APPROVAL COUPON

McGRAW-HILL BOOK COMPANY, Inc.
330 West 42nd Street, New York

You may send me a copy of the new third edition of French and Svensen's MECHANICAL DRAWING FOR HIGH SCHOOLS, $1.50, on approval. I understand that I am to return this book after a reasonable period of examination, unless I either notify you of my intent to adopt it in my classes or remit for it.

*Signed*_____

*Address*_____

*School*_____

*Official Position*_____ *I.A.V.E. 2-1-35*

(Continued from page 20A)

Study effect of an inductance in a.c. and d.c. circuits.
Connect and run a shunt motor.
Study the voltage drop in a line.
Study the use of fuses.
Make an extension cord.
Do other production jobs as time permits.

Vocational Electric Shop I

Study fundamental principles, resistance current and voltage.
Study properties of conductors and insulators.
Connections of voltage supplies in series and parallel.
House wiring, knob and tube, BX and conduit.
Study properties of a magnetic circuit.
Study power and energy consumption.
Heating principles.
Distribution systems.
Switchboards, control and protective apparatus.

Vocational Electric Shop II

Generator principles, d.c. and a.c.
Motor principles.
Performances tests of each.
Types of d.c. motors.
Methods of connecting.
Starters.
Windings.
Types of a.c. motors.
Types of windings used.
Starters.
Methods of connecting.

Vocational Electric Shop III

a.c. principles and apparatus.
Inductance, capacitance.
Reactance.
Impedance.
Ohm's law for a.c. circuits.
Power factors.
Single-phase and polyphase circuits.
Alternators and transformers.
Principles and testing of each.
Distribution systems.

Vocational Electric Shop IV

The fourth semester has no definite work outlined, but the boy has a chance to specialize in any line of work he chooses during this time.

Our Supplement

NAUTICAL WEATHER VANES

C. E. Bradley, Fall River, Massachusetts

(See Supplement No. 305)

A distinctive nautical weather vane that is properly constructed and mounted makes both a useful and ornamental accessory at the summer home, and is especially desirable at the camp on the shore or sea, or lake, or river. When made of softwood, the ships shown in Supplement No. 305, afford fascinating and interest-retaining projects for bench classwork. These weather vanes are especially useful as pleasing "extra" projects for students who complete the regular class assignments in shorter time than is required by the majority of the class.

The initial operation consists of making a cardboard template of the design selected. This is then transferred to the white-pine stock. The shape is sawed out, rounded, and tapered at the ends, and finally sanded smooth. The molding, trim, and rigging are then added.

After carefully painting and varnishing the vane in accordance with true maritime traditions, the effect is quite attractive.

SchoolShopEquipmentNews

ISSUE NEW ATKINS HOME WORKSHOP BOOK

E. C. Atkins & Company, Indianapolis, Ind., has issued the fourth edition of the *How-to-Do-It Book* for home workshops.

The booklet contains instructions, drawings, and photographs of a variety of projects for the school and home shop. The material will be found useful in planning and building a shop, a workbench, and a wall tool cabinet. The various types of wood joints, also are described.

NEW HOLD-HEET PYROMETER LANCE

The Russell Electric Company, 364 West Huron St., Chicago, Ill., has issued an illustrated circular, describing its new "hold-heet" pyrometer lance. This portable hand instrument will be

(Continued on page 40A)

THE K & E MASTER DRAFTSMAN CONTEST has created new interest and enthusiasm in hundreds of mechanical drawing classrooms. It ties up closely with the program of the Department of Secondary School Principals of the N. E. A. to commemorate the three hundredth anniversary of the founding of free education in the secondary schools of America.

This unusual contest carries the student back to 1635, creating imaginary situations as fascinating and intriguing as those of Mark Train's celebrated Connecticut Yankee in King Arthur's Court. It requires the student to originate modern adaptations of interesting, seventeenth century methods and objects. Contest closes March 15. There is still time to write for project sheets for classroom distribution.

KEUFFEL & ESSER DRAFTING MATERIALS also create student enthusiasm that will gratify you. Long experience in the manufacture of high grade drawing materials, slide rules and engineering equipment has been of immeasurable aid in the production of drawing materials for school use that incorporate many of the same admirable features but which can be offered at prices within the means of all students.

NEW EQUIPMENT

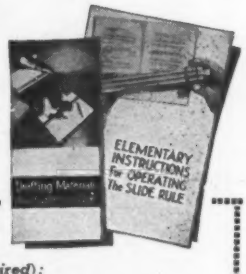
At this time many supervisors and teachers are giving careful consideration to the purchase of new mechanical drawing equipment. Keuffel & Esser Co. can fill your requirements from a wide variety of quality drawing materials representing the development of years of study and cooperation with school authorities. Inquiries are invited on all types of equipment.

KEUFFEL & ESSER CO.

HOBOKEN, N. J.

NEW YORK CHICAGO ST. LOUIS
SAN FRANCISCO MONTREAL

Drawing Materials *Slide Rules*
Surveying Instruments
Measuring Tapes



KEUFFEL & ESSER CO.
300 Adams St., Hoboken, N. J.

Kindly send me (check material desired):

- ☐ Full details of the K & E Contest and the three attractive project sheets;
- ☐ Your 12-page booklet, "Drafting Materials, Their Care and Use" and your "Manual of the Slide Rule";
- ☐ Classroom wall chart on the Contest;
- ☐ Catalog, "Drawing Materials for High Schools".

Name.....

Address.....School.....

Higgins' American

India Ink

Since the early days of industrial education and vocational arts in America, HIGGINS' DRAWING INKS have played an increasingly important and dependable role.

Recent years have witnessed the participation of thousands of students of mechanical drawing in the HIGGINS' AWARDS CONTESTS. Planned by Jos. H. Constantine, past president of the Eastern Arts Association and nationally known authority on vocational education, the projects which have made up this most interesting series of merit awards have materially aided many teachers and supervisors in providing a fresh viewpoint and in stimulating student enthusiasm and proficiency.

WRITE FOR PROJECT SHEETS AND AWARD CONTEST DATA

This year's contest is again a part of the group of national "Scholastic Awards" which have been officially endorsed by the Department of Secondary School principals of the N. E. A. in the celebration of the 300th Anniversary of the Founding of Free Education in the Secondary Schools of America. *Contest closes March 15.*

Specify—

HIGGINS' DRAWING INKS

by Name and Color!

BLACKS

General (Soluble) Waterproof

COLORS

All Waterproof

Carmine	Light Brown	Emerald Green
Scarlet	Orange	Blue Green
Vermilion	Chrome Yellow	Blue
Brick Red	Lemon Yellow	Indigo
Dark Brown	Neutral Tint	Violet
	White	

CHAS. M. HIGGINS & CO., INC.

271 Ninth St. Brooklyn, N. Y.

Manufacturers of Quality Inks and Adhesives Since 1880

(Continued from page 38A)

found useful for checking temperatures in all cases where a wall-type pyrometer is used. For general use, it has the additional advantage of portability. It is unequaled as an exploring instrument to gather heat data in chemical and industrial processes. As a "trouble shooter" and check tester in pyrometer installations, it is unexcelled and its low price makes its immediate adoption highly advisable.

The firm is equipped to furnish different types of thermocouples which are available for special applications. A special silver contactor disk enables the taking of quick, accurate readings in exploring surface temperatures on various appliances.

Complete information will be furnished to any shop instructor upon request.

PONY "C" CLAMPS

The Adjustable Clamp Company, 424 N. Ashland Ave., Chicago, Ill., is now marketing a pair of miniature Pony "C" clamps. These useful little clamps come in two sizes — the one having a maximum opening of 1 in., the other of 2 in. Both have a depth of throat of 1 in.

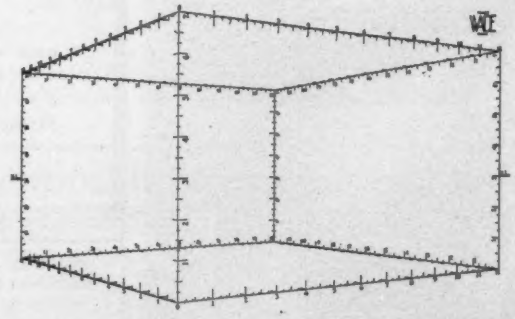
The frames are sturdily made of malleable iron. They are cadmium plated to protect them against rust. The screws are accurately cut, and the turned steel swivel is securely riveted to them.

A loose-pin handle provides ample leverage for firmly gripping anything to which the clamp is applied.

ANNOUNCE NEW WADE SKETCH PAPER

The Wade Instrument Co., 2274 Brooklyn Station, Cleveland, Ohio, has announced the development of a new line of sketch papers for school-shop use which embody a number of improvements.

The first is a new isometric-lined sketch paper, printed in green, with all axes spaced 1 in. apart and with subdivisions of ¼ in. The paper has no useless or confusing cross lines, the height is



measured on the vertical axis, the length on one isometric horizontal, and the width on the other. With this paper perfect isometric drawings may be quickly drawn freehand to any scale and in three dimensions.

Another type is the lined sketch paper, on which perspectives of any subject may be quickly drawn with the aid of a 12-in. straightedge. The paper is printed green, showing a transparent square prism, and each edge graduated 1 in., ½ in., and ¼ in. in perspective. Sketches may be made to any scale, direct from

(Continued on page 42A)

"Comes nearest to my idea of a textbook in the essentials of drawing I have ever seen."
ARTHUR R. MASON, *Supervisor, Jackson Public Schools, Jackson, Michigan*

BASIC UNITS IN MECHANICAL DRAWING, Books I and II

By RANDOLPH PHILIP HOELSCHER
Professor of General Engineering Drawing

and ARTHUR BEVERLY MAYS
Professor of Industrial Education
Both at the University of Illinois

●

The adoption list for "Hoelscher and Mays" has grown tremendously. Book I appeared in May, 1933 and already 120 schools are using it in quantity. Book II, published in June, 1934, was adopted by 32 schools for the fall semester of 1934. These two books sell themselves.

There must be a reason for this immediate popularity. Prominent teachers everywhere endorse "Hoelscher and Mays" for: the division of material into teaching or learning units, rather than the conventional chapters; the graded questions and problems; the selection of the subject matter of the units, their length and grouping; the illustrative line drawings; the emphasis on individual creative thought on the part of the student; the thorough treatment of the fundamental principles of mechanical drawing, together with the inclusion of units on some specialized applications which are of direct practical value to the student; and, *above all*, for their sound pedagogical basis.

Book I: 289 pages; 6 x 9; $1.60 **Book II: 277 pages; 6 x 9; $1.60**

Two Interesting Comments

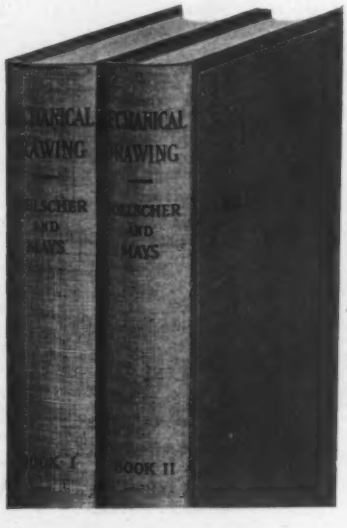
"As a teacher of trade drafting I wish to give this text my hearty endorsement. This has long been my idea of what a drafting text should be—especially the feature of questions and problems at the end of each chapter or basic unit of instruction. This text will fill a long-felt need for better organized instruction material and will prove a valuable aid to the teacher and student alike."

STANLEY S. RADFORD, *Arthur Hill Trade School, Saginaw, Michigan.*

●

"The book is as complete and accurate as any one of its kind that I have ever seen. The questions and problems outlined at the close of each chapter is a feature that I think is very desirable and should prove very valuable to any student or teacher using the book. I regard the publication as a distinct step in advance over anything we have had up to the present time and should be in the hands of all teachers and students doing this type of work. The price of $1.60 was a pleasant surprise; I don't see how you do it."

WAYNE WETZEL,
Western Illinois State Teachers College.



John Wiley & Sons, Inc.
440 Fourth Avenue, New York

Here
is a
NEW
Text on

ELECTRIC METERS

This new book has been published in response to a definite school demand for an elementary text that will give the student a working knowledge of the various types of meters so he will understand not only how to operate, but also how to use and care for them. The volume deals with A.C. and D.C. meters, measurements of power and resistance, watt-hour meter reading and testing, and graphic meters. Written by Richard R. Ranson, Experimental Department, Cutler-Hammer, Inc. Price $2.00.

Sent ON APPROVAL

Electric Meters, or any of the following recent texts, will be sent for 30 days on approval examination. Please give name of school and school connection when ordering to insure prompt delivery.

Automobile Service Shop Management	$1.50	Engineer Custodian Manual	$2.50
Television	2.00	Practical Mathematics	2.00
Pattern Making	1.75	Storage Batteries	1.50
Forging	1.25		

American Technical Society
Drexel Ave., at 58th St. Dept. HS37 Chicago, Ill.

DRAWING TABLES

Special equipment made to specification for School and College Drafting Rooms. The table shown above is arranged to accommodate six students, with six individual drawers, and a six drawing board cabinet.
Inquiries solicited

ARTIST MATERIALS
DRAWING MATERIALS
SCHOOL SUPPLIES
F. WEBER CO.
Established 1853

Factory Office, P. O. Box 1095 Philadelphia, Pa. St. Louis, Mo. Baltimore, Md.

(Continued from page 40A)

the subject, and any point in the prism may be quickly and accurately located. The paper is made in two sizes, 8 by 13, and 13 by 16 and will be found useful by architects, artists, draftsmen, and students.

NEW DRAFTING-INK BOTTLE

The Eugene Dietzgen Company, 2425 Sheffield Ave., Chicago, Ill., have just marketed a new improved drawing-ink bottle.

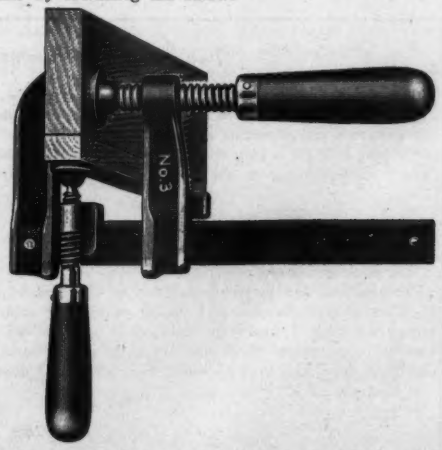
The draftsman will find that the bell-shaped cork of this new bottle can be withdrawn easily from its bell neck. Furthermore, that the cork will always make a tight closure when it is again returned. The cork, of course, is equipped with the usual quill,

but its top also has been improved. The new hexagon shape given to the top prevents it from rolling off even an inclined drafting board. Only those who have crept around under drawing tables recapturing an escaped ink-bottle cork of the old type will fully realize what this improvement means.

SPECIAL CLAMP EQUIPMENT

The Hartford Clamp Company, Burnside, Conn., has produced a number of special clamping devices that will be very useful in the school shop. Among them are the deep-engagement clamps, edge-clamp attachments, and the miter clamp.

The deep-engagement clamp has a new locking device, which, when pressure is applied, instantly locks and will neither slip nor stick. Vibrations set up by hammering or other means will not loosen the clamp which, nevertheless, can be removed easily at any time by loosening the screw.



The edge-clamp attachment is especially useful for edge gluing. With this attachment on hand, the long clamps and expensive clamp equipment can be saved for large work. The attachment, therefore, prevents cumbersome and awkward working set-ups, and saves both time and labor. It is easy to handle, quickly adjusted, and comes in two sizes.

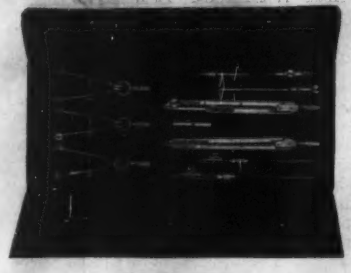
The miter clamp is equally efficient and useful on work requiring pressure to be applied on miter joints.

(Continued on page 49A)

POST'S

Complete Line of Drafting Instruments and Materials

A set from the "Junior Line"



Set No. 97130

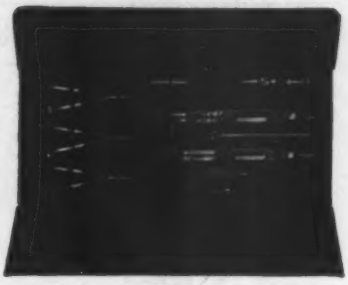
No. 97130—Complete with velvet lined Pocket book style case, one each 4½" and 5½" ruling pens with releases, 3½" bow divider, 3½" bow pen, 5½" plain divider; 5½" compass with fixed needle point leg, divider part, pen part and lengthening bar with straightening device and repair vial, List price $7.60, *less substantial discount to Educational Institutions.*

See catalog for complete sets. List prices ranging from $2.00 upward.

No. 97110—Complete with velvet lined Pocket book style case, one each 4½" and 5½" ruling pens with releases, 3½" bow divider, 3½" bow pencil, 3½" bow pen, 5½" Hairspring divider, 5½" compass with jointed legs, pen part, lengthening bar and straightening device, List price $11.40, *less substantial discount to Educational Institutions.*

See catalog for complete sets. List prices ranging from $2.00 upward.

A set from the "Student Line"



Set No. 97110

Drawing Boards

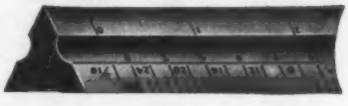
No. 97251—Basswood, ¾" thick; shellacked, has two drawing surfaces.

List price—

Size	12 x 17	16 x 21	18 x 24	20 x 24½	20 x 26	23 x 31
List price each	.62	.92	1.14	1.22	1.30	1.80

Less substantial discounts to Educational Institutions.

Triangular Boxwood Scales



No. 97301—Made of best grade seasoned boxwood; machine divided, guaranteed accuracy, divided 1/8, 1/4, 1/3, 3/8, ½, ¾, 1, 1½, and 3" to a foot—List price each $.50. Same scale maplewood, List price $.42 each.

Less substantial discounts to Educational Institutions.

Triangles and Curves

No. 97746-B

No. 97884

style 6 13 17

Made of good transparent high grade celluloid.

Triangles	6"	8"	10"
No. 97746-A—30 x 60 degree List Dozen		3.40	4.75
No. 97746-B— 45 degree List Dozen	3.40	4.75	

Irregular Curves

No. 97884 Style	6	13	17
List Each	.36	.54	.54

Less substantial discounts to Educational Institutions.

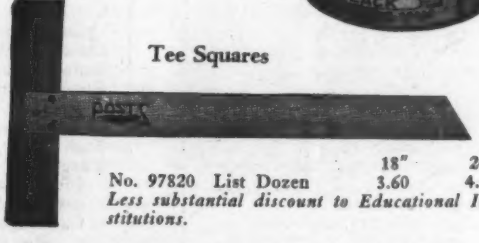
Drawing Ink

No. 92422—smooth flowing, extra waterproof, dense and opaque.

List price ¾ oz. bottle each	$ .25
½ pint	1.95
1 pint	3.70
1 quart	6.80

available in black and twelve brilliant colors. *Prices subject to substantial discount to Educational Institutions.*

Tee Squares



	18"	24"
No. 97820 List Dozen	3.60	4.50

Less substantial discount to Educational Institutions.

The Frederick Post Company

Address All Mail P. O. Box 803, Chicago.

Main Plant

Chicago - - Illinois

The Frederick Post of Wisconsin
125 E. Wells St., Milwaukee, Wis.

Canadian Distributors
The Hughes Owens Co., Ltd., Montreal

Write for complete catalog and Book of Drawing and Tracing Papers.

FREDERICK POST COMPANY P. O. Box 803 Chicago, Ill.

Gentlemen:—Please send me a catalog of your complete line of School Drafting Materials and sample book of drawing and tracing papers.

Name.....Position.....

School.....

City.....State.....

Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets.

Name and Description	No.	Name and Description	No.	Name and Description	No.
Bench Grinder		**Coil**		**Pliers**	
Benches		Spreader		Gas, 6½"	
Plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets		Taper		Gas, 8"	
Bits		Winder		Side-cutting, 6"	
Auger, ¼" to 1" by 16ths, each		**Desk**		**Punches**, assorted, sets	
Auger, $\frac{11}{16}$", 18" long		Teacher's, with drawer compartments		**Punch**, for metal molding	
Drill, for wood, square shank, ⅛" to ½", by 16ths, each		Chair, to match desk		**Reamers**	
Expansion		**Drill**		Pipe burring, ¼" to 1"	
Extensions, 18"		Breast		Pipe burring, ½" to 2"	
Screw-driver, ¼"		Concrete, ⅜", ½", ¾", 1", each		**Rules**	
Blackboard		Hand		48" zigzag	
Permanent or portable		Portable Electric		72" zigzag	
Blowtorches, 1-qt. size		Twist, $\frac{1}{32}$" to ⅜" by 32nds, each		**Screw Drivers**	
Bookcase		**Drill Press**		3"	
For reference books, catalogs, etc.		Bench, hand or power driven		5"	
Braces, ratchet-type, 8" swing		Heavy, power driven		8"	
Bulletin Board		**Files**		**Shears**, for cutting metal molding	
Cabinets		**First-Aid Cabinet and Supplies**		**Soldering Coppers**, assorted	
Wood or metal, for filing class records, instruction sheets, drawings, etc.		**Hack Saw**		**Soldering Copper**, electric	
Chairs		Blades, 10", 24 teeth per inch. Gross		**Soldering-Copper Handles**	
Tablet-arm chairs		Frames, adjustable		**Solder Dippers**	
Compass Saw		**Hammers**		**Stocks and Dies**, for pipe threads, ½" to 1"	
		Claw, 12 oz		**Vises**	
		Machinists', ball-peen		Machinists', 4"	
		Hickey, ½" and ¾", each		Pipe	
		Lathe		**Wrenches**	
		Engine, 10" or 12" swing, 6' or 8' long		Adjustable, 6"	
		Speed		Adjustable, 8"	
				Pipe, 10", 12", and 14", each	
				Socket, combination, sets	

ELECTRICAL SHOP—SUPPLIES

Name and Description	No.	Name and Description	No.	Name and Description	No.
Armored Cable		Couplings, for flexible		white pine, dressed 4 sides, pc.	
2-wire, No. 14, single-strip, ft.		Lock nuts, ½", ¾", and 1" each		**Molding**	
3-wire, No. 14, single-strip, ft.		Rigid, ½", ¾", and 1", ft. each		Metal, ft.	
Box connectors		**Condulet**		Metal, fittings—crosses, tees, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches. Each	
Attachment Plug		Fillings, ½", LL, LR, and LB, each		Wood, 2-wire, with capping, ft.	
Battery Acid, 1.300 carboy		Covers, ½", blank		Wood, 3-wire, with capping, ft.	
Batteries, dry cells		**Door Openers**, mortised		**Nails**, roofing, lb.	
Battery-Sealing Compound, lb.		**Emery Cloth**, 1½" wide, rolls		**Nuts**, iron, 4-36, 6-32, 8-32, 10-24, 12-24, 10-32, 14-20, gross each	
Bar Hangers		**Fixtures**, brass-chain, suspension		**Outlet Boxes**, 4" square, with one round blank cover, and one cover with bushed opening, each	
Box Cleats		**Fixture Studs**		**Pipe Straps**, galvanized, ⅜", ½", ¾", and 1". lb. each	
Brads, ¾", No. 19, and 1½", No. 16, lb. each		**Fish Paper**, .0125" thick, sq. yd.		**Push Buttons**	
Brake Lining, ¼"x 2" ft.		**Fuses**		Return-call, 3-point	
Brushes, carbon, for motors and generators		Plug-type, renewable, 125-volt, 15 amp		Single-piece	
Burglar Contacts		Cartridge-type, renewable, 125-volt, 30 amp		**Receptacles**	
Open-circuit		Renewals for plug fuses		Flush, duplex	
Closed-circuit		Renewals for cartridge fuses		Porcelain-cleat, 660-watt, 250-volt	
Bushings		**Ground Clamps**, ⅜" to 1", assorted		Concealed	
Loom, No. 1 and No. 2, each		**Hickey Grips**, ½" and ¾", each		Covers	
"Jiffy" loom No. 2		**Lamps**		**Resistance Units**, 125-ohm	
Buzzers		Carbon, 220-volt, 60 watt		**Rosettes**, wood	
Cleats, unglazed porcelain, 2-wire		Mazda, 10-watt, type B, 120-volt			
Clips, test, with insulators, Universal, Nos. 22, 23, 24, and 25. Each		Guards, for brass sockets			
Commutator Cement, cans		**Leather Nail Heads**			
Conduit		**Lugs**, 25 and 50 amp			
Bushings, ½", ¾", and 1". each		**Lumber**, 2"x 4"x 14', No. 1,			
Box connectors, for flexible.					

(Contined on page 46A)

General Electric Company

General Office: Schenectady, N. Y.

Sales Offices: Address Nearest Office

Akron, Ohio, 106 S. Main St.
Atlanta, Ga., 187 Spring St. N.W.
Baltimore, Md., 39 W. Lexington St.
Binghamton, N. Y., 19 Chenango St.
Birmingham, Ala., 600 N. 18th St.
Boston, Mass., 140 Federal St.
Buffalo, N. Y., 1 West Genessee St.
Butte, Mont., 20 W. Granite St.
Cedar Rapids, Ia., 203 Second St., S.E.
Charleston, W. Va., 304 Capitol St.
Charlotte, N. C., 200 S. Tryon St.
Chicago, Ill., 230 S. Clark St.
Cincinnati, Ohio, 215 W. Third St.
Cleveland, Ohio, 4966 Woodland Ave.
Columbus, Ohio, 40 S. Third St.
Dallas, Texas, 1801 N. Lamar St.
Davenport, Ia., 511 Pershing Ave.
Dayton, Ohio, 25 N. Main St.
Denver, Colo., 650 Seventeenth St.
Des Moines, Ia., 418 W. Sixth Ave.
Detroit, Mich., 700 Antoinette St.
Duluth, Minn., 14 W. Superior St.
El Paso, Tex., 109 N. Oregon St.
Erie, Pa., 10 E. Twelfth St.
Fort Wayne, Ind., 1635 Broadway
Fort Worth, Tex., 408 W. Seventh St.
Grand Rapids, Mich., 148 Monroe Ave., N.W.
Hartford, Conn., 338 Ann St.
Houston, Tex., 1016 Walker Ave.
Indianapolis, Ind., 110 N. Illinois St.
Jackson, Mich., 212 Michigan Ave., W.
Jacksonville, Fla., 237 W. Forsyth St.
Kansas City, Mo., 106 W. 14th St.
Knoxville, Tenn., 602 S. Gay St.
Los Angeles, Calif., 5201 Santa Fe Ave.
Louisville, Ky., 455 S. Fourth St.
Memphis, Tenn., 8 N. Third St.
Milwaukee, Wis., 940 W. St. Paul Ave.
Minneapolis, Minn., 107 S. 5th St.
Nashville, Tenn., 234 Third Ave., N.
Newark, N. J., 744 Broad St.
New Haven, Conn., 129 Church St.
New Orleans, La., 837 Gravier St.
New York, N. Y., 570 Lexington Ave.
Niagara Falls, N. Y., 201 Falls St.
Oklahoma City, Okla., 119 N. Robinson St.
Omaha, Nebr., 409 S. 17th St.
Philadelphia, Pa., 1405 Locust St.
Phoenix, Ariz., 441 W. Madison St.
Pine Bluff, Ark., 501 Main St.
Pittsburgh, Pa., 436 Seventh Ave.
Portland, Ore., 621 S. W. Alder St.
Providence, R. I., 76 Westminster St.
Richmond, Va., 700 E. Franklin St.
Rochester, N. Y., 89 East Ave.
St. Louis, Mo., 112 N. Fourth St.
Salt Lake City, Utah, 200 S. Main St.
San Antonio, Tex., 201 Villita St.
San Francisco, Calif., 235 Montgomery St.
Schenectady, N. Y., 1 River Rd.
Seattle, Wash., 821 Second Ave.
Spokane, Wash., 421 Riverside Ave.
Springfield, Ill., 607 E. Adams St.
Springfield, Mass., 116 Liberty St.
Syracuse, N. Y., 113 S. Salina St.
Tacoma, Wash., 1019 Pacific Ave.
Toledo, Ohio, 405 Madison Ave.
Trenton, N. J., 143 East State St.
Tulsa, Okla., 409 S. Boston St.
Utica, N. Y., 258 Genessee St.
Washington, D. C., 806 15th St., N.W.
Waterbury, Conn., 72 W. Liberty St.
Wichita, Kans., 116 So. Main St.
Worcester, Mass., 165 Commercial St.
Youngstown, Ohio, 25 E. Broadman St.

Canada: Canadian General Electric Company, Ltd., Toronto **Hawaii: W. A. Ramsay, Ltd., Honolulu**

Motor Dealers and Lamp Agencies in all large cities and towns

DISTRIBUTOR FOR THE GENERAL ELECTRIC COMPANY OUTSIDE OF THE UNITED STATES AND CANADA.

INTERNATIONAL GENERAL ELECTRIC CO., INC.

New York, N. Y., 570 Lexington Ave. Gen. Sales Office, Schenectady, N. Y.

G-E Educational Service

The General Electric Company is deeply interested in education, as it recognizes that the future welfare of industry, and of the country as a whole, depends upon how well the students of today are trained for the work of tomorrow. It is the policy of the Company to aid the faculty and students of our schools and colleges in every way possible. To this end, Company publications, motion-picture films, illustrated lectures, etc., are made generally available without charge.

General Electric engineers will be glad to recommend apparatus to meet your special conditions if you will give them details such as: Type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company.

Illustrated Lecture Service

General Electric Motion Pictures are available without charge to educational institutions. They are particularly valuable to schools and colleges, as they enable the student and teacher to keep informed on all important developments in the electrical field.

Complete information on this service is available in publication GES-402B.

In general the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.

Where standard apparatus is not suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop. Among such special equipment may be mentioned the switchboards both for engineering and physics laboratories, special industrial control panels for A-C. and D-C. service, the AHI synchronous motor (or generator), and the 5 kw. rotary converter.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185A, which has been recently revised, illustrates and describes G-E apparatus particularly adapted for laboratory use.

Selection of Electrical Shop and Laboratory Equipment

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62A will be particularly useful. In this booklet will be found listed in six different groups, equipment to meet a wide range of requirements. For the elementary courses a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well balanced laboratory equipment which will permit a particularly wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

Shop Projects

The General Electric Company, in carrying out its elaborate educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop due to the fact that they are not merely assembly projects but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The projects already issued and available without charge cover:

Educational Projects. ¼ H.P. and ¾ H.P. Motors.

1) ¼ H.P. Single-Phase, 60 cycle, 110 volt motor Bulletin GED-379
2) ¾ H.P. 3-Phase, 60 cycle, 110 volt motor Bulletin GED-534
3) ½ kw. 220–110/55 volt, single-phase, air-cooled transformer Bulletin GET-128

Kits for these projects can be purchased from the General Electric Company. In addition, complete instructions are given for the securing of any equipment that may not be included in the kit.

(Continued from page 44A)

Name and Description	No.	Name and Description	No.	Name and Description	No.
Screws		**Solder Wire,** 50/50, size No. 10, lb.		Rubber, ½-lb. rolls	
Anchors, 8/32, 10/24, 12/24, 14/20, each		**Soldering Paste,** 2-oz. cans, noncorrosive		**Tubes**	
Machine, round-head, ¼", 4-36; ½", 6-32; ¾", 6-32; ⅜", 8-32; ½", 8-32; 1", 8-32; ⅜", 10-32; ⅜", 10-24; ¾", 10-24; ¾", 10-32; 1", 12-24; gross each size		**Soldering Salts,** 1-oz. cans, noncorrosive		Porcelain, $\frac{5}{16}$"x 3"	
Machine, brass, round-head, ¼", 4-36; ½", 6-32; ¾", 6-32; ½", 8-32; gross each size		**Split Knobs,** porcelain		Porcelain, $\frac{5}{16}$"x 5"	
Wood, flat-head bright, ¾" No. 5, ½" No. 8, ¾" No. 8, 1" No. 7, 1½" No. 8, 1½" No. 10, 2" No. 7, gross each size		**Switch**		Porcelain, $\frac{5}{16}$"x 10"	
Wood, round-head blued, 1" No. 7, 1½" No. 8, 1½" No. 10, 2" No. 7, gross each size		Battery, 4-point		**Tubing**	
Sleeving, No. 1, white, No. 1, blue, and No. 1, red. Spools each		Bases, porcelain for 10-amp. switches,		Flexible nonmetallic, ¼", ft.	
Sockets, brushed brass		Boxes, 2¾" deep		Flexible nonmetallic, ⅜", ft.	
Pull-chain		Entrance, safety, 2-pole, 30-amp., with 2-branch lighting circuits		**Washers**	
Keyless		Entrance, safety, 3-pole, 30-amp., 250-volt		Iron, ¼" and ⅜", lb. each	
Key		Flush, push-button, S.P., D. P., 3-way, 4-way, each		Brass, ¼" and ⅜", lb. each	
Socket Caps, ¼" brushed, ⅜" bushed, each		Surface, S1		**Wire**	
Porcelain keyless, with caps		Surface, S3		Annunciator No. 18 or No. 20, lb.	
		Surface, S4		Fixture, No. 18, single yellow, with marker, ft.	
		Knife, type A, D.P.S.T., D.P. D.T., S.P.S.T., and S.P.D. T., each		Fixture, No. 18, single yellow, with marker, ft.	
		Surface, snap, electrolier		Rubber covered, solid copper, No. 10, black, ft.	
		Surface, snap, S.P.D.P., 3-way, 4-way, each		No. 10, white, ft.	
		Tacks, double-pointed No. 10, lb.		No. 14, black, ft.	
		Tape		No. 14, white, ft.	
		Friction, ½-lb. rolls		Rubber covered, No. 16, brewery cord, ft.	
				No. 18, lamp cord, green and yellow, ft.	
				S.C.C. copper magnet, enameled, sizes, Nos. 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, lb., each	

Electrical Shop—Motor and Testing Equipment

Name and Description	No.	Name and Description	No.	Name and Description	No.
Annunciators		volt, a.c.		ing from 1 to 12, 6- and 12-volt batteries	
Automatic needle-drop		Voltmeter, standard, 125-volt, d.c.		**Relays,** Dixie	
Gravity-drop		Voltmeter, student, 110-volt, d.c.		**Resistance Boards,** for testing.	
Manual needle-drop		Voltmeter, student, 110-volt, a.c.		**Rheostats**	
Armatures, burnt-out, for repairing		Wattmeter, standard, 110-220-volt, 30-60-amp., d.c.-a.c.		Compression, 275-watt	
Battery Charger, commercial.		Wattmeter, student, 110-220-volt, 30-amp., a.c.-d.c.		Field, for shunt and compound motors	
Circuit Breakers		Watt-hour Meter, 125-volt, 5 amp., a.c., single-phase, various makes		**Rotary Converter,** 5-kw. capacity, 3-phase, a.c., 110-volt d.c.	
Air, single-pole, overload, 25-amp., 550-volt		**Motors**		**Speed Counters,** 0-9999	
Air, single-pole, underload, 15-amp., 550-volt		Auto starter, different makes		**Spring Balances,** 0-30 lb.	
Controllers		Burnt-out, fractional h.p., 110-volt, 60 cycle, for repairing		**Starting Boxes**	
For multiple-speed motor		Compound, 1 h.p., 110-volt, d.c.		For compound motors, various makes	
For 1-h.p., 110-volt series motors		Multiple-speed, 1 h.p., 3-phase, 220-volt		For shunt-wound, 1 h.p., 110-volt motors. Overload release	
Generators		Series, 1 h.p., 110-volt, d.c.		For shunt-wound, 1 h.p., 110-volt motors. No voltage release	
Motor-generator set, 10-h.p., to supply 110-volt d.c., for testing purposes, battery charging, etc.		Shunt, 1-h.p., 110-volt, d.c.		Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt, a. c. motors	
Generator, 6-volt d.c., coupled to an a.c. motor, for 6-volt circuit testing		Split-phase and repulsive, a. c., 110-volt, single-phase, assorted		**Storage batteries,** 6-volt	
Auto generators of different makes		Split-phase induction motors, fractional h.p., 110-volt, 60-cycle, different makes		**Switchboard,** as required	
Gravity Cells		3-phase, 1 h.p., a.c., 220-volt, various makes		**Telegraph Sets,** including sounders, keys, and relays, each	
Magnets, testing, 10,000-ohm		3-phase, 2 h.p., 220-volt, a.c., various makes		**Telephones**	
Meters		Universal, fractional h.p., 110-volt, different makes		Complete bridging, independent phones	
Ammeter, standard, 60-amp., a.c.		Universal, variable-speed, ½ h.p.		Couch vestibule telephones	
Ammeter, standard, 60-amp., d.c.		**Platform Scale,** 100-lb. capacity		Receivers, transmitters, induction coils, condensers, and bridging switch hooks, each	
Ammeter, student, 60-amp., a.c.		**Rectifiers,** Tungars, for charg-		**Transformers**	
Ammeter, student, 60-amp., d.c.				Bell-ringing, 6-8-14-volt	
Voltmeter, standard, 0-10-volt, d.c.				Single-phase, 110-220-volt, S. K.V.A.	
Voltmeter, standard, 110-220-volt, d.c.-a.c.					
Voltmeter, standard, 125-					

ADVERTISING PAGES REMOVED

(Continued from page 42A)

NEW GLUE HANDBOOK

The Keystone Glue Company, Williamsport, Pa., has issued a very serviceable and useful glue handbook, containing in 59 pages all that a craftsman needs to know about the history, manufacture, and use of glue in industry and the school shop.

The book describes in detail the process of glue manufacture, how glue is graded, tested, classified, and how and where it is used in woodworking and other industries. One chapter enumerates the remedies for glue troubles. A useful glossary is appended.

A PRIMER OF SHEET IRON

The Republic Steel Corporation, Youngstown, Ohio, has issued a 64-page booklet entitled, *A Sheet Iron Primer*, which tells the story of iron, traces its early history, and explains the various processes of annealing, galvanizing, and sheet rolling. Chapters are included dealing with rust and corrosion, purity and uniformity, and age of alloys. Tables of gauges and sizes of iron and steel sheets also are included.

A copy of the booklet may be obtained by the shop instructor upon request.

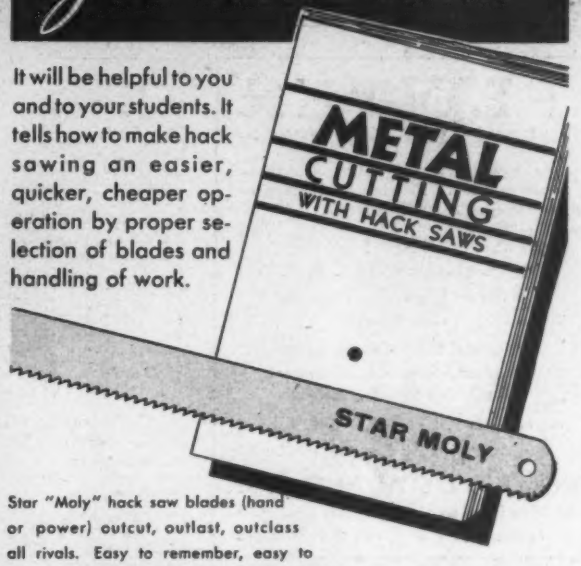
NEW THURSTON SUPPLY CATALOG

The Thurston Supply Company of Anoka, Minn., has issued its twentieth annual catalog of "hard-to-get" materials for 1934–35.

The catalog contains 68 pages, listing and describing a wide line of materials, tools, and supplies required by workers in wood, upholstering, leather, electricity, caning, weaving, and finishing. A full line of decalcomania transfers, inlays, moldings, and cabinet hardware is shown.

A copy of the catalog will be sent to any school-shop instructor upon request.

Get this book



It will be helpful to you and to your students. It tells how to make hack sawing an easier, quicker, cheaper operation by proper selection of blades and handling of work.

Star "Moly" hack saw blades (hand or power) outcut, outlast, outclass all rivals. Easy to remember, easy to prove. Sold only through distributors.

CLEMSON BROS., INC.
MIDDLETOWN, N. Y.

5016

NEW MATERIAL
For Teachers of Industrial Arts
80 PROJECTS and LESSONS CAREFULLY ARRANGED

Master drawings printed in duplicating ink, ready to make hectograph copies for each pupil. Projects for first and second year, prepared by J. Ernest Kuehner and Raymond E. Knoeppel of St. Louis, both Industrial Arts teachers of many years experience. Each project a Master sheet guaranteed to reproduce from 50 to 75 copies on any gelatin duplicator. They are time savers for teachers and get results. Written in words and terms boys of 12 to 15 years of age with little or no manual training can understand.

SPECIAL OFFER: The complete assortment of 80 projects for $3.00 or you may select only those projects that fit your course at 10¢ each.

Sample page and complete list of projects free on request.

MORGAN-DILLON & CO.
Publishers of Educational Material
3152 N. CLARK ST. CHICAGO, ILL.

NEW CATALOG
"HARD-to-GET" MATERIALS

Cabinet hardware, glue, finishing materials, upholstering fabrics, transfers, electric clock movements, bridge arms, tea wagon wheels and hundreds of other items all at wholesale prices.

Our 20th Annual Catalog is free for the asking.

THURSTON SUPPLY COMPANY
Jobbers and Manufacturers
ANOKA MINNESOTA

ART LEATHERS
FOR CRAFT WORKERS

A 5-cent stamp brings you samples. (Samples free to teachers, camp instructors, etc. Send your request on official letterhead or give your connections.) Sold by the whole or half skin also cut to measure. Tools, designs, lacings, both in calf and goat skin, snap fasteners to match leathers, leather dye, wax polish. Sphinx Paste, slide fasteners and bag plates.

W. A. HALL & SON
Dept. B 250 Devonshire St., Boston, Mass.

Student Demonstration Log—FREE

Students can actually see and handle this marvelous discovery

More convincing than 10,000 words, this demonstration log is a solid piece of Plastic Wood, and tells more strikingly—the uses, the advantages of this marvelous discovery. One of these logs will be mailed to all instructors, or those interested in this product, free of charge.

1001 Uses
Plastic Wood is actual wood in putty form. When dry, it is hard, permanent wood that can be sawed, planed, sanded; will hold nails, screws; will adhere to any clean, dry surface—wood, metal, glass, stone or porcelain.

FREE LOG—Write The A. S. Boyle Company, Inc., 1934 Dana Avenue, Cincinnati, Ohio, Dept. IA-2, for Free Log.

PLASTIC WOOD

The School Shop Shopping Guide

PEWTER

SCHOOLS! — CLUBS!

We Specialize In All Your Requirements. Pewter and Britannia Made in ANY Form.

BRITANNIA METAL

Rolls – Sheets – Circles – Rods – Wires — Engraved – Designed Fancy Borders

Britannia Slush Casting Metal
Wire and Special Strip Solder
Blank and Powder Solders

» NO ORDER TOO SMALL «

WHITE METAL ROLLING & STAMPING CORP.
80 Moultrie St. Brooklyn, N. Y.
Telephones, EVergreen 9-4134-5-6

LEATHERCRAFT

INTRODUCTORY OFFER

That you may become acquainted with the fascinating art of leathercraft at a minimum expense we offer the following:

A Leather Modeling Tool.
A Natural Russ.a Calf Bookmark.
Four Bookmark Designs.
A folder of Leathercraft Instructions.
A 28 page Illustrated C:talog::s of leathers, tools, designs, patterns and supplies.

All of the above sent promptly, postage free, on the receipt of $.40 in stamps or coin.

Our stock of craft leathers, tools, patterns, designs, lacing and accessories you will find exceptionally complete. Send for a free catalogue. A sample card of leathers will also be sent on request.

If you live in New York phone or write concerning our Leathercraft classes.

FOLEY-TRIPP CO.
Dept. A-2. formerly Foley-Hummel Co.
193 WILLIAM ST. NEW YORK, N. Y.

Sheet Metal Working —
Its value as a vocational subject for school shops—the Projects—Aims of the Course—Equipping for teaching Sheet Metal Work—Application and other things you would like to know are fully covered in our new bulletin.
Write for your copy—No. SB35

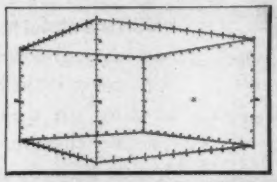
Our Second Century — PEXTO — Guaranteed Products

The Peck, Stow & Wilcox Co.
SOUTHINGTON, CONNECTICUT

CASTINGS

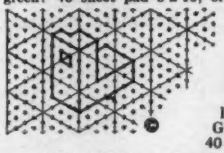
and Blue Prints to Build a large variety of fine HOME WORKSHOP MACHINES in the school shop. Castings made to order. Send for free catalog.

DESIGNERS COMPANY
724 Monroe Ave. RACINE, WIS.



Wade's NEW PERSPECTIVE Lined Sketch Paper

for perfect drawings of any subject, to scale. Teaches perspective! Graduated prism eliminates tedious inaccurate gauging of lengths, height, etc. Printed green! 40 sheet pad 8 x 13, or 20 sheets 13 x 16, $1.00.

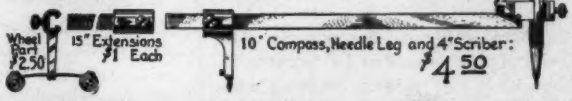


ISOMETRIC Lined Sketch Paper
for freehand drawings of any subject in three dimensions to any scale. Just follow the green guide lines. Divided 1" and ¼". Greatly improved. Pads of 40 sheets 8 x 13 $1.00.

"USE WADE PAPERS IN YOUR DRAWING CLASSES"

A NEW BEAM COMPASS

Holds your favorite ruling pen, or most any round, flat or odd section. Light hard Duralumin! Micro-adjustment. Satin finish. Perfectly balanced.



WADE AUTOMATIC IRREGULAR CURVE

Automatically forms a new and perfect irregular curve at every slightest adjustment of the clamp. Steel core in rubber strip, bevel edges. Metal drawing edge. 7" drawing edge size $2.00; 12" $2.50; 18" $3.00. 4 larger sizes.

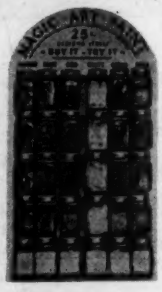
400 MECHANICAL PARTS—
A chart showing line drawings of all kinds of screws, bolts, bearings, oil and grease cups, nails, machine parts, springs, structural shapes, rivets, valves, fittings, gears, etc. Every student should own one.

See Wade instruments and papers at your dealer's or write for large folder.
Quantity discount to Schools!

WADE INSTRUMENT CO.
MANUFACTURERS
2274-F Brooklyn Station
CLEVELAND, O.

MAGIC ART PAINT

DESIGNS ITSELF



Dealers Display Board

MOST SENSATIONAL DECORATIVE PAINT FINISH CREATED

MAGIC ART PAINT is a decorative finish easily applied to any surface, on which it forms the most artistic and beautiful designs while drying. Available in all colors. If unobtainable at your local Paint or Hardware store send us 25c for trial jar.
Pamphlet on request.

MAGIC ART PAINT COMPANY
Hasbrouck Heights N. J.

PROOFREADING!

Lessons in proofreading, interesting and practical, for printing and English classes; especially adapted to grades VII and VIII; an eight-page booklet.

Single copy 12 cents, 10 copies $1.00, 100 copies $4.50. Postage paid to any part of the U. S. A.

Birchen-Garden Press
50 Fitch Hill Ave. Fitchburg, Mass.

The Bemis Standard

A Manual Training Bench that stands the test of time
Details on request

A. L. BEMIS 68 Commercial St. Worcester, Mass.

- a complete line of authentic scale SHIP MODELS, suitable for work in the shop, club or classroom. Easy to build, interesting, instructive, inexpensive. An asset to your mantelpiece; an illustrated education in ship-lore. See your nearest dealer or write for a catalogue.

megow's

MODEL AIRPLANE SHOP
Howard & Oxford Streets, Philadelphia

MOIST OR DRY MODELLING AND POTTERY

CLAY

in all quantities

We also carry Red-burning Clay, Grog, Pottery Glazes, Modelling Tools and all Ceramic Supplies.
Write for Free Sample or Catalogue

CERAMIC ATELIER
733 So. Kilbourn Ave. Chicago, Ill.

BOWS AND ARROWS

Any wideawake youngster would rather make a bow than a breadboard. *Let him make something HE can use.*

L. E. STEMMLER CO.
Queens Village, New York

A complete line of raw materials and accessories at popular prices.

Write for FREE Catalog No. 10
BOWS AND ARROWS